British Phycological Bulletin

VOL. 2 No. 1

1960

CAL

RY

Issued by
THE BRITISH PHYCOLOGICAL SOCIETY
© 1960

INFORMATION FOR CONTRIBUTORS

CONTRIBUTIONS are invited on subjects of interest to phycologists, including reports of meetings, book-reviews or abstracts of papers published in out-of-the-way journals. Manuscripts should be submitted before **March 1st** in any year to the Hon. Editor, **Dr. E. Conway, Dept. of Botany, University of Glasgow, Scotland.**

Manuscripts can only be accepted when type-written, in double spacing and with wide margins. Authors are asked to be concise, and only in exceptional circumstances can footnotes be accepted.

Headings should be clearly denoted in the typescript but should not be underlined except where a word is to appear in italics when printed.

All scripts should be carefully checked for errors before being submitted; only a minimum number of corrections can be allowed free at the proof stage.

REFERENCES should be given in the form used by the *Journal of Ecology*: all abbreviations must be in line with the form adopted by the *World List of Scientific Publications* (1952 ed.). Authors are asked to check their reference abbreviations with care.

FIGURES in line drawing can be accepted (usually by individual arrangement) if they are drawn in Indian ink on good white card and made not larger than 10 × 8 in. including a wide margin. Lettering should also be in ink.

REPRINTS can usually be arranged and should be ordered at the proof-reading stage.

PRINTED BY BELL & BAIN, LTD., GLASGOW

Vol. 2, No. 1 October, 1960

CONTENTS

Page

Council and Subcommittees of the British Phycological Society 1960 2

Editorial 3

Meetings of the Society :

Summer Meeting, Northumberland, August 1959 3

Eighth Annual General Meeting, London, January 1960 5

Financial Statement of the British Phycological Society for the year ending November 5th, 1959 8

Phycology at the IXth International Botanical Congress :

Montreal Meeting and Post-Congress Excursion to Nova Scotia. By E. M. Burrows and P. S. Dixon 9

Pre-Congress Excursion to British Columbia. By H. Blackler 10

14th Congress of the International Association of Limnology. By J. W. G. Lund 11

Abstracts of Papers read at the London Meeting 1960 12

Algal Species Lists :

Algae collected on the Northumberland Coast, August 1959. By W. E. Jones 20

Preliminary List of the Marine Algae of the Galloway Coast. By E. M. Burrows 23

Marine Blue-Green Algae from the Island of Barra. By W. D. P. Stewart 26

Notes on Important Algal Herbaria, II. By P. S. Dixon 28

Letters to the Editor :

Heteromorphic life-history as a family criterion in the Cladophorales. By A. Archer and E. M. Burrows 31

Some British freshwater material of *Asterocytis*. By J. H. Belcher and E. M. F. Swale 33

Observations on the spore output of some common red algae. By A. D. Boney 36

Spore output of *Antithamnion plumula* over a number of days. By A. D. Boney 37

Nurture of a fruiting *Antithamnion* tuft and the physiological condition of the liberated spores. By A. D. Boney 38

Reviews :

B. Fott : *Algenkunde* 39

C. A. M. King : *Beaches and Coasts* 40

Report of the Freshwater Biological Association, 1958-9 41

News-Bulletin of the Phycological Society of America, 1959 41

News Items 41

Request for Research Material 42

Obituary : Professor G. M. Smith 43

THE BRITISH PHYCOLOGICAL SOCIETY

MEMBERS OF COUNCIL AND SUBCOMMITTEES FOR THE YEAR 1960

Officers of Council

President: Dr Mary W. Parke

Vice-Presidents: Professor J. Feldmann, Dr M. B. E. Godward

Hon. Secretary:
Mr H. T. Powell, Marine Station, Millport, Isle of Cumbrae, Scotland

Hon. Treasurer:
Dr M. T. Martin, University Hall, Bangor, Caernarvonshire, North Wales

Ex-Officio Members of Council

Immediate Past-President: Dr J. W. G. Lund

Hon. Editor of the British Phycological Bulletin:
Dr Elsie Conway, Department of Botany, The University, Glasgow, W.2

Other Members of Council

To retire January 1961	*To retire January* 1962
Dr E. M. Burrows	Dr G. T. Boalch
Dr G. E. Fogg	Dr P. S. Dixon
Dr Margaret Naylor (Mrs. A. Roberts)	Mr R. Ross

Hon. Auditors: Dr D. J. Crisp, Dr J. K. Spearing

Editorial Committee for the British Phycological Bulletin:
Dr E. Conway (Editor), Dr J. W. G. Lund, Dr M. T. Martin

Committee for Marine Algal Check-list and Flora:
Dr M. W. Parke (Chairman), Dr P. S. Dixon (Secretary), Dr H. Blackler, Dr E. M. Burrows, Dr R. W. Butcher, Mr N. I. Hendey, Mrs Dorothy Hepper, Dr M. T. Martin, Dr M. Naylor, Mr H. T. Powell

Committee for Algal Nomenclature:
Mr R. Ross (Secretary), Dr P. S. Dixon, Mr E. A. George, Dr J. W. G. Lund, Dr M. W. Parke

Committee for Protection of Collections and Slides of Freshwater Algae:
Dr J. W. G. Lund (Secretary), Mr E. A. George, Mr R. Ross

EDITORIAL

Earlier numbers of the *British Phycological Bulletin* were preliminary ones necessary in the early years of a young Society; with this number, however, the format is changed to that of a more conventional journal. This seems a suitable moment at which to start volume 2; the previous numbers (Nos. 1-7) will therefore constitute volume 1, and an index to the volume is in course of preparation.

The Editor invites all members to contribute to the journal of their Society; articles on any topic of interest to phycologists will be welcome and should be sent before March 1st to the Hon. Editor, Dr Elsie Conway, Dept. of Botany, The University of Glasgow.

MEETINGS OF THE SOCIETY

(a) **SUMMER MEETING AT MONKS' HOUSE, SEAHOUSES, NORTHUMBERLAND**

15th-21st August, 1959

There seems to be a quite widely held opinion that the north-east coast of England is not a particularly interesting region for the marine phycologist, but this will be strongly denied by those who took part in the 1959 Field Meeting. The number of species collected was not large, but several were unfamiliar to those of us more used to collecting in the south or west, and the shores were full of ecological interest.

The meeting was centred on the Monks' House Bird and Field Observatory, where Dr and Mrs E. A. R. Enion made our party very welcome and comfortable and helped us in many ways. A small laboratory was available and was the scene of considerable activity every evening.

The coast from Berwick to Alnmouth is generally rather flat. The shores include many sandy beaches, backed by dunes, and broad rock platforms. These are mostly of sandstone and shales with limestone outcrops, but there are also a number of dykes of quartz dolerite. The most impressive dolerite feature is the Whin Sill, which meets the coast at Bamburgh just north of Monks' House and reappears offshore to form the Farne Islands.

The range of ordinary spring tides is about 14 feet along this coast. The dominant winds are north-easterly and shores facing this direction are the most exposed.

During the meeting the following excursions were made:

16th August: Monks' House rocks, a level platform near the Observatory, provided a useful introduction to the area. Very large plants of *Rhodomela lycopodioides* were found, and we were surprised to see numerous fresh cystocarpic plants of *Bonnemaisonia asparagoides* and *Halymenia latifolia* drifting in from offshore.

In the afternoon the party visited the Dove Marine Station at Cullercoats, a visit kindly arranged by Dr H. O. Bull. Dr J. A. Allen generously gave up his Sunday afternoon to show us the laboratories and aquarium and outlined the research being carried out there.

17th August: A visit was made to Beadnell Bay, with its extensive platform of sandstone and shales with limestone reefs. In the deep gullies and pools at the outer edge of the platform, *Odonthalia dentata* was seen (for the first time by many members). The rocks round these pools carried an unusually thick covering of *Himanthalia* buttons. In midshore pools on the southern headland of the bay were found small plants of *Codium fragile* var. *atlanticum*, which Moss (1957) suggests is a recent colonizer of the Northumberland coast.

18th August: The party crossed to the Farne Islands in a Northumberland coble, passing large numbers of Atlantic seals on the smaller islets. Most collecting was done in the channel (or " Gut ") between Brownsman and Staple Islands of the Outer Farnes. This channel was dry at low water, sloping into deep water at either end. In a pool at the highest part of the Gut large plants of *Laminaria digitata* were found, with undivided fronds. These resembled the plants which members who attended the Society's first meeting will remember seeing in the Church Island channel in the Menai Straits. In both places there are strong tidal currents, but there is probably much greater wave action in the Gut.

19th August: The party crossed the sand flats to Holy Island where, after a hurried look at Lindisfarne Priory, the time was spent collecting at the southern end of the island. Here the shore was sheltered by a boulder ridge and consisted, at low water, of a network of shallow pools with pebbly bottoms. *Alaria esculenta* occurred here, as elsewhere on this coast, in situations apparently more sheltered than those it occupies in the west, and accompanied by such species as *Laminaria saccharina*, *Gracilaria verrucosa* and *Halidrys siliquosa*.

20th August: One of Batters' classical collecting grounds, the Meadowhaven rocks at Berwick-on-Tweed, was visited. This shore was sheltered by a boulder ridge and consisted of shales with limestone outcrops. Its main feature was a series of eroded synclines producing very large, saucer-shaped pools, some connected to the sea at L.W.S.T. The bases of these pools were usually covered with sand and pebbles, the latter very often encrusted with *Lithothamnion* spp. Here *Alaria* occurred in situations rather similar to those on Holy Island.

21st August: The last day was spent at Boulmer, where the party found a broad platform of millstone grit through which a series of deep channels ran parallel to the shore. In these, *Halidrys*, *Laminaria digitata* and other Phaeophyceae were growing luxuriantly. In pools at the outer edge of the platform, *Odonthalia* was again plentiful.

Within the algal classes included in Batters' list (1889) the only new record was *Halymenia latifolia*. The finding (in the drift) of numerous specimens of *Bonnemaisonia asparagoides* is interesting since it was recorded as rare by Batters.

In all these excursions, the local knowledge of Dr Alan Lacey was invaluable, and his efforts contributed very largely to the success of the meeting.

W. Eifion Jones

(b) EIGHTH ANNUAL GENERAL MEETING, LONDON

4th-5th January, 1960

By kind permission of Professor L. J. Audus, a meeting of the British Phycological Society was held in the Department of Botany, Bedford College, Regent's Park, London, on Monday, 4th January, and Tuesday, 5th January, 1960. Mr L. P. Turnbull acted as Local Secretary. Thirteen members stayed in one of the College residences (44 Nottingham Place) near to Bedford College; and about 60 people attended the meetings.

The programme included: three sessions in the Darwin Lecture Theatre devoted to **papers and discussion** relating to many aspects of phycological research; **exhibits** in the Botany Department; the **Eighth Annual General Business Meeting**; and a **Phycological Society Dinner** at Bedford College.

Professor L. J. Audus took the chair for the opening session (2.15 p.m. on 4th January) and cordially welcomed members of the Society to this the second meeting of the Society to be held at Bedford College. The following papers were read (see authors' abstracts on pp. 12-19).

1. Mr L. P. Turnbull (Bedford College). 'The use of *Chlamydomonas moewusii* Gerl. as an organism for general botanical research: some aspects of the physiology of sexual reproduction.'
2. Miss R. M. Burdett (Bedford College). 'The effect of gibberellic acid on the growth of *Chlamydomonas moewusii* Gerl.' (Paper read by Mr Turnbull.)
3. Miss B. I. Cronin (Bedford College). 'Some aspects of inheritance in the haploid organism *Chlamydomonas moewusii* Gerl.'
4. Dr J. D. Dodge (Birkbeck College). 'Nuclei, nuclear division and taxonomy in the Dinophyceae.'

The papers were followed by interesting discussions. After tea in the Refectory, exhibits relevant to papers being read at the meeting were on view in the Botany Department.

During Monday evening a most enjoyable Phycological Society Dinner—organized by Mr Turnbull—was held at Bedford College. Twenty-seven members and guests were present. After dinner the President, Dr Mary Parke, warmly thanked our hosts at Bedford College (particularly Professor Audus and Mr Turnbull) for all the trouble they had taken to make the Society welcome and the meeting a success.

The second session started at 9.30 a.m. on Tuesday, 5th January, with Dr Mary Parke in the chair. One report and two papers were read, as follows:

5. Mr R. Ross (British Museum). 'Some decisions of the Nomenclature Section of the 1959 Botanical Congress in Montreal.'
6. Dr P. S. Dixon (Liverpool). 'Some aspects of algal typification.'
7. Mr H. T. Powell (Millport). 'The typification of *Fucus spiralis* L.'

Each paper was followed by a short discussion. Afterwards Dr Helen Blackler showed a number of colour-slides taken by her during the 1959 Botanical Congress and excursions in Canada. The slides included views of shores and algae on both Pacific and Atlantic coasts, and were much appreciated.

The **Eighth Annual General Meeting** was held at 11.30 a.m. (see minutes below).

The third and final session started at 2.15 p.m., with Dr M. B. E. Godward (Vice-President) in the chair. The programme included three papers, as follows:

8. Mr J. Nizam (Queen Mary College). 'Desmids and *Chlorella* in experimental culture.'
9. Mr W. Marshall (Edinburgh). 'An underwater study of the epiphytes of *Laminaria hyperborea* (Gunn.) Fosl.'
10. Dr M. Neushul (Scripps Institution, California). 'Observations on sublittoral Antarctic marine algae.'

A short lantern lecture was then given by Mr H. T. Powell (Millport) describing expeditions in which he had taken part to the small Scottish islands of North Rona and Sula Sgeir (1958) and the Flannan Isles (1959).

In conclusion, the Chairman thanked all the speakers for their papers and/or their contributions to discussions, and proposed a vote of thanks to the staff of Bedford College, particularly to Professor Audus and Mr Turnbull, for their hospitality and help in arranging the meeting. The exhibits were again on view in the Botany Department for the rest of the afternoon.

MINUTES OF THE EIGHTH ANNUAL GENERAL BUSINESS MEETING

The Eighth Annual General Meeting began at 11.30 a.m. on Tuesday, 5th January, 1960, in the Darwin Lecture Theatre. The President, Dr Mary W. Parke, was in the chair, and 41 members were present.

1. **The Minutes of the Seventh Annual General Meeting,** held at University College, London, on 2nd January, 1959, had been circulated in *Brit. phycol. Bull.*, No. 7, and were now approved.

2. **Report of Hon. Secretary for the year 1959.** (*a*) *Meetings.* During the year two general meetings were held—the winter meeting at University College, London (the Seventh A.G.M.), on 2nd and 3rd January (see report in Bulletin No. 7), and the seven-day Field Meeting based at Monks' House Observatory, Seahouses, Northumberland, 15th–22nd August. Only eight people attended the Field Meeting, but they much enjoyed the varied programme arranged by Dr W. E. Jones. (For a report on the Seahouses meeting, see p. 3.)

   (*b*) *The* 1959 *Council* met on four occasions: on 2nd January at University College, London; on 1st October at the University of Liverpool; and two meetings on 4th January, 1960, at Bedford College, London.

   (*c*) *Subcommittees.* (i) *The Subcommittee for Marine Algal Check-list and Flora* met at Liverpool on 30th September, 1959, and at Bedford College on 4th January, 1960. The Society is trying to obtain finance to employ a research assistant to assist with work on the Flora projects of this committee. The first part of the proposed Biological Flora of British Marine Algae is now ready for publication. The Honorary Secretaryship of this committee has passed from Dr E. M. Burrows to Dr P. S. Dixon, and Council wishes to record its thanks to Dr Burrows for the valuable work she has put in as Hon. Secretary of the committee since it was established in January, 1953. (ii) *The Subcommittee for Algal Nomenclature.* The Secretary, Mr R. Ross, attended the meeting of the Special Committee for Algae during the Nomenclature Sessions at the Montreal Congress, and he reports on p. 16 some of the decisions of the Congress that particularly affect the nomenclature of algae.

   (*d*) *British Phycological Bulletin.* The issue of Bulletin No. 7 (dated July, 1959) was held up until September as an indirect outcome of the printers' strike during the summer. Bulletin

No. 7 was the largest so far, containing 83 pp. Forty-one libraries now receive the Bulletin, 10 of them overseas. Bulletins Nos. 1–7 (some 320 pp.) will be regarded as Vol. 1, and it is hoped to issue an index to Vol. 1 in due course. The next Bulletin will therefore begin Vol. 2, and it has been decided to print rather than to mimeograph future numbers. This more expensive method of production will make it necessary to curtail the contents of the Bulletin somewhat and to increase the charge to subscribing libraries from 7s. 6d. to £1 per year. Dr E. Conway will continue to be Editor of the Bulletin, and Dr J. W. G. Lund and Dr M. T. Martin will join her on a newly established Editorial Committee to assist with certain editorial tasks. The Council has decided not to sponsor a new Phycological Journal at the present time.

(*e*) *Membership.* During the year the membership increased from 112 to 122.

3. **Report of Hon. Treasurer.** Dr M. T. Martin presented the Income and Expenditure Account and the Balance Sheet for the year ended 5th November, 1959 (see copy on p. 8), and added that the amount of our Assets *on deposit* at the bank has since been increased to £250.

   The reports of the Secretary and the Treasurer were adopted.

4. **Election of Auditors for 1960.** Dr J. K. Spearing was re-elected; and it was agreed to invite Dr D. J. Crisp (Bangor) to serve instead of Professor W. T. Williams, who wished to resign as auditor.

5. **Election of Officers and Members of Council for 1960.** Officers and Members of Council for 1960 were elected as shown on p. 2 of this Bulletin.

6. Other items of business consisted of: (i) comments from Dr E. Conway on certain matters relating to the Bulletin; (ii) a progress report from Dr W. E. Jones (Hon. Assistant Secretary) on the Field Meeting to be held at Guernsey in September, 1960; (iii) an announcement by Dr J. M. Kain that a collection of sublittoral algae from the Azores was available for study at Port Erin.

H. T. Powell, *Hon. Secretary*

BRITISH PHYCOLOGICAL SOCIETY

INCOME AND EXPENDITURE ACCOUNT FOR YEAR ENDED NOVEMBER 5TH, 1959

Expenditure		
Printing Bulletin No. 7 and Reprints - -	£140 7 9	
Postage and Editor's Expenses - - - -	3 15 9	
		£144 3 6
Postages, Stationery, Circulars and Telephone - - -		18 5 7
Expenses of January Meeting - - - - - -		8 15 1
Subscription to Biological Council - - - - -		0 10 0
Subscription to " Council for Nature " - - - -		1 0 0
Surplus		36 3 6
		£208 17 8

Income		
Subscriptions received, 1959 - - -	£115 0 1	
Less: Subscriptions received in arrears, 1958 - - - - - -	5 0 0	
Less: Subscriptions received in advance, 1960 - - - - - -	6 0 0	
Add: Subscriptions in arrears, 1959 -	8 0 0	
		£112 0 1
Sale of Bulletins - - - - - - - - - -		18 0 4
Sale of Reprints - - - - - - - - - -		15 12 3
Sale of Record Cards - - - - - - - - -		0 9 0
Add: Payment due for Reprints from Bulletin No. 7 - -		60 11 3
Interest on Deposit Account - - - - - -		2 4 9
		£208 17 8

BALANCE SHEET AT NOVEMBER 5TH, 1959

Capital and Liabilities	
Capital at November 6th, 1958 - - - - - - -	£220 17 9
Subscriptions in advance for 1960 - - - - - -	6 0 0
Add: Surplus	36 3 6
	£263 1 3

Assets		
Balance at Bank - - - - - - - - - -		£90 5 3
On Deposit - - - - - - - - - -		102 4 9
Subscriptions in arrears, 1959 - - -	£8 0 0	
Subscriptions in arrears from 1958 - -	2 0 0	
		10 0 0
Payment for Reprints (in arrears) - - - - -		60 11 3
		£263 1 3

(Signed) M. T. MARTIN, *Hon. Treasurer*

We certify that the above Balance Sheet and Income and Expenditure Account are in accordance with the books and vouchers of the British Phycological Society, which we have duly audited, and in our opinion they give a true and correct view of the transactions of the Society for the period from November 6th, 1958, to November 5th, 1959, and its position at November 5th, 1959.

(Signed) W. T. WILLIAMS
JOHN K. SPEARING } *Hon. Auditors*

PHYCOLOGY AT THE IXTH INTERNATIONAL BOTANICAL CONGRESS

August, 1959

(a) THE MONTREAL MEETING AND THE POST-CONGRESS EXCURSION TO NOVA SCOTIA

The growing interest in the study of algae was reflected at the VIIIth International Botanical Congress in Paris in 1954 by the creation of a separate section for phycology, and the justification for this was shown in Montreal by the large attendance at the meetings of this section. A number of problems have arisen, however, as a result of the increasing size of the Congress as a whole, both in the number of sections and in the membership of each. There are very few cities in which suitable lecture-theatre accommodation is available within a sufficiently limited area. Despite often rigid adherence to timetables and the generosity of the local authority in Montreal in providing free transport between buildings, it was extremely difficult for members to select from the programmes of more than a very limited number of sections.

A second difficulty is the result of the very diverse interests of members still within a single section, if the Congress is to serve the function of integrating knowledge in any particular field. In Montreal the channelling of discussion through symposia on special topics helped to bring more unity into the meetings and gave rise to some valuable discussion. Symposia were held on ' Ecology of marine algae,' ' Ecology of freshwater algae,' ' Modern views on algal phylogeny,' ' Electron microscopy and algal structures,' and ' Recent developments in the culturing of algae.' Papers were grouped into sessions on ' Marine algae,' ' Freshwater algae ' and ' Planktonic marine algae,' and one practical problem discussed was the possibility of establishing a permanent international culture collection of algae.

A number of inter-sectional symposia also interested phycologists, as, for example, that entitled ' Motile flagellated cells in plants,' but attendance at such meetings is now so large that free exchange of ideas is no longer possible.

For most visitors to Montreal, the close proximity and excellent common-room and other facilities of the halls of residence of McGill University and of the University of Montreal enabled much informal discussion to be held at all hours of the day, and especially in the (only comparative) cool of the evening. This was extremely valuable.

One important social event was a meeting of the American Phycological Society held in Montreal during the Congress to enable its foreign members and guests to attend. The hospitality of the American Phycological Society was much appreciated and the meeting was valuable in that it gave a point of contact between Societies from several different countries.

A few members of the British Phycological Society joined in the post-Congress trip to the Maritime Provinces of Canada. The first part of this excursion was led by Dr A. R. A. Taylor and was centred in Fredericton, New Brunswick, while the second part, mainly centred in Halifax, Nova Scotia, was led by Miss C. MacFarlane. Thanks to the excellent and luxurious modes of transport and to the very careful organization by the leaders and their helpers, the members of the excursion were able to visit considerable expanses of the coasts of New Brunswick and Nova Scotia and to see a land and also a marine flora in some ways very different from that of our own country. Visits were made to marine stations and research institutions, and many opportunities were given to sample the delicious products of local industries. We should like to thank our hosts in Montreal and in the Maritime Provinces for their very generous hospitality.

E. M. Burrows
P. S. Dixon

(b) PRE-CONGRESS EXCURSION TO BRITISH COLUMBIA

One of the pre-Congress excursions to British Columbia included a short phycological field trip to Vancouver Island. Dr R. F. Scagel was the leader of a small but international party composed of Professor J. Feldmann, France; Professor Yamada, Japan; Dr G. Oberländer, San Francisco; Dr A. R. A. Taylor, New Brunswick; and Dr Helen Blackler, Great Britain.

After an informal reception in Vancouver on the evening of August 1st, the phycologists made a 5 a.m. start for a seven-day tour of Vancouver Island. The party was based at Point no Point on the west coast, which made it possible to visit a variety of shores. Much interest was felt by European botanists in seeing the algal zonation of Brandon Island, described by Professor and Mrs Stephenson in 1949 (*J. Ecol.*, **37**, 289); especially striking were the slippery silt-covered boulders of Whiffen Spit at Sooke, with their great beds of *Macrocystis integrifolia* showing at low tide (a place where *Scytosiphon lomentaria* was among the few British species of algae found on the Pacific coast), and the open coast exposed to much surf action at Botany Beach, Port Renfrew, with *Postelsia palmaeformis* and *Lessoniopsis littoralis* on the rocks at low water and *Nereocystis luetkeana* in the deep gullies. It is of interest to recall that Botany Beach was the site of the Seaside Station of the University of Minnesota, to which Dr Josephine Tilden used to take parties of students at the beginning of the century. The long journey from their University 2,000 miles away had to be completed by walking down an old logging trail; to-day, the Station has quite disappeared, but the trail was so overgrown that one wondered if the students of Minnesota were the last people to use it!

During the week, a day was spent at the Friday Harbor Laboratories of the University of Washington on San Juan Island, Puget Sound. This visit was much enjoyed, for it was a very great pleasure to see not only the well-equipped laboratories but also the large kelps of the Pacific, *Agarum fimbriatum*, *Costaria costata* and *Cymathere triplicata*, as well as huge sheets of *Desmarestia latissima* and *D. foliacea*. Most of the collecting at Friday Harbor is done by dredging; and numerous Pacific members of the Rhodophyceae (including a number of species of *Callophyllis*) were seen in this way.

On August 8th the phycologists rejoined the pre-Congress party, and a memorable visit to British Columbia ended with several days collecting flowering plants from the coastal region, the arid areas of the interior and the foothills of the Rocky Mountains.

Helen Blackler

THE 14TH CONGRESS OF THE INTERNATIONAL ASSOCIATION OF LIMNOLOGY

August, 1959

Nearly 300 of the participants to this very successful Congress spent their first day in Austria going by boat from Linz to Vienna. This gave them a chance to meet one another and discuss matters of mutual interest. From August 21st there was a programme of lectures interspersed with excursions. The lectures, many of which were of interest to phycologists, were so numerous that four synchronous sessions had to be held. There were also special sessions in which the field covered by the relevant section was reviewed and, with time available, vigorous discussion was possible. Of especial interest was the plenum covering primary and secondary production (Profs. W. Rodhe and W. T. Edmondson). Prof. O. Jaag delivered the Baldi Memorial Lecture (Selbstreinigungsmechanismen in Fliessgewässern).

All phycologists will be delighted to hear that Dr F. Hustedt was one of the three scientists awarded the Association's Einar Naumann Medal for his outstanding contributions to our knowledge of diatoms.

During the Congress there was an interesting excursion to the Neusiedlersee and saline ponds in this area. Some of us were able to see the Rost Canal where Prof. J. Schiller has discovered so many new algae. The main Congress excursion starting on August 25th was in three parts and included the famous biological station at Lunz. It was also a great pleasure to be able to be with Prof. F. Ruttner, the doyen of Austrian limnologists, on his home ground as well as elsewhere. There was an opportunity to see the Salzkammergut lakes, and all the parties met at Scharfling and on August 31st saw something of the recent severe flood damage. A small, informal, but very useful symposium on primary production and the ^{14}C method was held at Scharfling.

The Congress ended at Salzburg on September 2nd, when it was announced that the next meetings would be in the U.S.A. and Canada in 1962, in Poland in 1965 and in Norway in 1968.

The post-Congress excursions gave opportunities to visit alpine reservoirs, one 2,036 m. above sea level, the Franz-Josef-Haus near the top of the Gross Glockner Pass, the Pasternerz Glacier and the nearby nature reserve, and the Carinthian lakes. Prof. Findenegg, who discovered " Meromixis " in these lakes and has carried out important investigations on their plankton, was our leader. Prof. Frey demonstrated cores of mud at Langsee. From Klagenfurt some participants went to Innsbruck and on September 7th to the Finstertalerseen (up to 2,258 m. above sea level), observing some magnificent growths of *Trentepohlia iolithus* on the way.

This short resumé gives little idea of the very interesting and delightful time spent in Austria. The work of the Austrian Organizing Committee was beyond praise. In addition to the scientific activities, we received wonderful hospitality in various parts of the country and enjoyed generous libations of local wines. Even the weather, which had so recently produced a national disaster, appeared to be organized by our hosts for our benefit. That we were able to visit almost every area of limnological interest in the country despite the difficulties arising from the recent floods was something of a miracle also performed by the Austrians. Few participants probably realized the disruption caused by these floods to the plans so arduously and carefully prepared by our hosts.

J. W. G. LUND

AUTHORS' ABSTRACTS OF PAPERS READ AT THE EIGHTH ANNUAL GENERAL MEETING, LONDON

4th and 5th January, 1960

1. The use of *Chlamydomonas moewusii* Gerl. as an organism for general botanical research: some aspects of the physiology of sexual reproduction.

L. P. Turnbull

Arguments were presented in support of the view that it is necessary for a large number of workers in many fields to concentrate on a common material in order to answer the question: what is the physico-chemical organization of life? This and the following two papers were presented in support of this argument. The suitability of *Chlamydomonas moewusii* Gerl. for an extremely wide range of studies was shown, and present and past researches utilizing this organism were reviewed. An account of the behaviour of the organism *en masse* in culture was given and the life-history and methods for initiating changes of state (motile-coccoid-palmelloid-sporing-sexually active) were described.

Various aspects of the physiology of reproduction were discussed and, in particular, the mechanism of sexual attraction and the nature and differences of the sexual strains (+ and −) and their mating intensities (valences).

Experiments were described in which results indicate that the sexual attraction involves some physical phenomenon associated with actively motile cells rather than a chemotaxis. Difference in rate of movement of cells is shown to be associated with variation in both length and rate of oscillation of the flagella. Whereas the difference in rate of movement between + and − individuals of the same valence is accounted for by a difference in flagella length, the difference in rate of movement between two valences of the same sexuality seems to be one of rate of oscillation of the flagella.

The actual mating begins with flagella fusion and therefore involves an agglutination reaction which must be dependent on the molecular structure of the external surface of the flagella. Probably + and − strains differ in this respect.

Evidence points to the view that sexual behaviour is connected with the expending of energy via flagellary action. Lewin (1956) states that the action spectrum of motility and of mating ability are coincident with the absorption spectrum of chlorophyll and suggests that energy from light is being made directly available by chloroplast pigments. In the present study it is shown that the valence of a strain can be altered by subtracting part of the spectrum from the light received but under none of the circumstances investigated can the mating reaction be changed.

Light-controlled differences may therefore account for variation in valence, but + and − strains must possess inherent differences in flagella formation which involve both the amount of flagella material produced and the molecular structure at the external surface. That is, in *Chlamydomonas moewusii* sexual valence may be relative but sexuality itself is probably not.

Reference

Lewin, R. A., 1956. Control of sexual activity in *Chlamydomonas* by light. *J. gen. Microbiol.*, **15**, 170–185.

2. The effect of gibberellic acid on the growth of *Chlamydomonas moewusii* Gerl.

R. M. Burdett and L. P. Turnbull

Chlamydomonas moewusii Gerl. is of obvious advantage for the study of the effect of gibberellic acid upon growth. Cell division is regular and rapid and can be measured directly by the number of individuals in a culture; cell extension is regular and any change in cell size is measurable; changes in cellular constitution and metabolic activity are readily assessed.

Six treatments in the range 1 p.p.m.–700 p.p.m. were applied to coccoid cells of *Chlamydomonas* cultured on plates of mineral agar. At daily intervals, over a period of 12 days, a sample of agar was removed and the individuals were washed into a counting cell where counts were made of cell numbers; cell size was measured and any other effects were noted.

Gibberellic acid is shown to have a definite and consistent effect on both rate of cell division and rate and amount of cell extension. After five days' treatment, cell numbers are increased to between 2 and 3 times those in the controls. During the same interval of time, cell expansion is slightly less than in the control, but after a further four days, during which cell division has almost ceased, cell diameter in the treated cultures has reached between 0·3 and 2 times that in the control. No attempt is made to relate effect and concentration in this discussion.

Other effects are seen in the mature cultures. Treatment with over 100 p.p.m. of gibberellic acid prevents motility, i.e. flagella formation, and causes cells to become rounded, thin-walled and pale yellow-green in colour. These results have unexpectedly substantiated the thesis of Lewin (see previous abstract). A change in pigmentation is shown to be accompanied by inability to form flagella and suggests that utilization of light energy and flagella formation are closely linked.

In a further experiment, young treated cultures of *Chlamydomonas* were made to mate. A decrease in sexual activity is caused by concentrations of acid lower than 100 p.p.m. and above this concentration motility could not be induced.

These observations indicate that sexual activity is closely linked with both utilization of light energy and flagella formation.

In *Chlamydomonas* we have an organism in which the effects of gibberellic acid are immediately obvious, easily analysed and wide open to manipulation. In the analysis of the effect of gibberellic acid on *Chlamydomonas* additional evidence has come to light suggesting that various factors associated with sexual activity are in fact linked.

3. Some aspects of inheritance in the haploid organism *Chlamydomonas moewusii* Gerl.

B. I. Cronin and L. P. Turnbull

It was noted that cultures of *Chlamydomonas moewusii* Gerl. varied with respect to a number of characters, and that these characters were passed from generation to generation. The mechanism of inheritance of two of these characters has been investigated. Normally, *Chlamydomonas moewusii* is oval in shape and a rich grass-green in colour. Isolates were made of + and − strains in which shape was normal but colour was pale yellow-green, and of + and − strains in which colour was normal but shape was round. In culture, pale colour and round shape often occur together and it was thought that they might possibly be linked in some way.

Crosses were made and the products of zygote germination isolated and cultured through several successive generations. Neither character studied was in any way linked with sexuality.

Shape has been shown to be genetically controlled. All individuals in the F_1 generation of the cross oval × round are oval in shape, and segregation in the F_2 generation is in the Mendelian ratio of 3 : 1 with oval dominant to round. Because *Chlamydomonas* is haploid, it is suggested that shape is determined during zygote division and is the phenotypic expression of a character operating in the diploid generation and controlled by a single pair of alleles.

Colour control is not straightforward. Whereas pale × pale gives all pale-coloured individuals and dark × dark gives all dark-coloured individuals, pale × dark has all the F_1 intermediate in colour. Selfing these intermediates produces an F_2 in which the majority of cells are intermediate in colour but many are pale and many are dark. Chi square tests on the results of several of these crosses show that the inheritance does not conform to expected ratios. The dark colour (normal) is always in excess of the pale. Colour inheritance is not controlled by a single pair of alleles, and it is suggested that a multiplicity of factors are operating. The possibility of some of these being extra-nuclear is not excluded.

Insufficient data are available to show whether or not the two characters are genetically linked, but it is noted that in the previous paper cells treated with gibberellic acid were round, pale yellow-green and of low sexual valence. This suggests that the two characters studied here are possibly linked in some way. The sexual intensity of mating reactions was not studied in these experiments.

4. Nuclei, nuclear division and taxonomy in the Dinophyceae.

J. D. Dodge

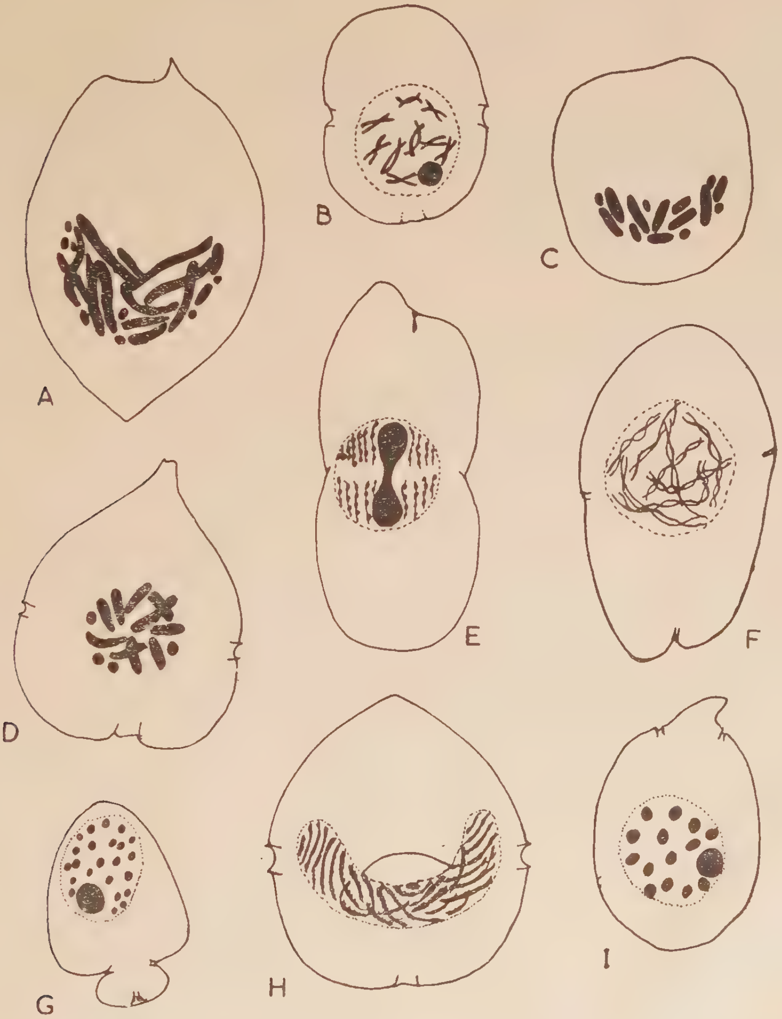
The nuclei of the Dinophyceae have been found to contain chromosomes which, unlike ordinary chromosomes, are always stainable even in interphase. The nuclear division also differs considerably from the " classical type." The most striking difference is the absence of a spindle. At metaphase the chromosomes lie across the equatorial plate; then, at anaphase, the chromatids, which possess no centromere, separate from one another, remaining parallel but with their free ends moving towards the " poles." Variations of this mitosis are found in species with long chromosomes, such as *Prorocentrum micans* and *Goniaulax tamarensis*.

There is little possibility of using the chromosome numbers taxonomically owing to the difficulty of counting the large numbers so unfavourably arranged. The estimations which have been made suggest one group of species having about 30 chromosomes and another with about 60. Of much greater taxonomic value in this group are the general nuclear characters. Some tentative conclusions may be drawn.

There appears to be no difference between the nuclei of *Prorocentrum* (Fig. A) and *Exuviaella* (Fig. C), and these are both found in the same family of the Desmokontae. In the Dinokontae we find *Oxyrrhis marina* (Fig. E) and *Gyrodinium cohnii* in separate families, but perhaps they should be more closely related, for both have a permanent endosome which divides at anaphase. *Amphidinium* (Fig. I) and *Massartia* (Fig. G), having similar nuclei with spherical chromosomes, should be separated from *Gymnodinium* (Fig. B) and

Gyrodinium fissum (Fig. F), which have a distinctive prophase and long chromosomes, instead of sharing the same family with them. In the order Peridiniales the interphase nuclei of *Peridinium* (Fig. D), *Goniaulax* (Fig. H) and *Ceratium* (all in different families) are somewhat different but the mitosis of *Goniaulax* and *Ceratium* is very similar.

These findings suggest that nuclear characters should be used in the taxonomy, of the Dinophyceae at least, on an equal basis with the more traditional morphological characters.



Diagrams of Dinophycean Nuclei
(relative sizes approximate only)

A. *Prorocentrum micans*—interphase
B. *Gymnodinium vitiligo*—prophase
C. *Exuviaella baltica*—interphase
D. *Peridinium trochoideum*—interphase
E. *Oxyrrhis marina*—anaphase
F. *Gyrodinium fissum*—prophase
G. *Massartia rotundata*—interphase
H. *Goniaulax tamarensis*—interphase
I. *Amphidinium klebsii*—interphase

5. Some decisions of the Nomenclature Section of the 1959 Botanical Congress in Montreal.

R. Ross

The Montreal Congress made the following decisions particularly affecting the nomenclature of algae:

1. All the generic names proposed for conservation by the Special Committee for Algae were conserved.
2. The later starting points for the nomenclature of some groups were retained.
3. Names of taxa originally described as animals must fulfil all the requirements of the botanical Code before they can be treated as validly published botanical names, including the Latin diagnosis requirement. If, when they are transferred to the plant kingdom, their names have not been published in accordance with the requirements of the botanical Code, these requirements must be fulfilled and the previous name adopted, unless some provision of the botanical Code prevents this.

6. Some aspects of algal typification.

P. S. Dixon

The present chaos that exists in algal taxonomy and nomenclature is the result, essentially, of the failure to recognize and interpret seasonal and environmental modifications of the external form of the thallus and of the failure by phycologists to refer back to original materials.

The term " type " is defined in Articles 7 and 8 of the *International Code of Botanical Nomenclature* and the only interpretation of this definition is that the association of a name and a specimen comes about as a result of the use of a specimen for the preparation of a description of the taxon to which the name is applied. The primary aim of typification is the elimination of arbitrary and subjective judgments, resulting in a clear indication of the application of a name. Interest in the application of the type method in phycology has been delayed considerably, which is surprising, because the need for typification is probably greater for the algae than for any other part of the plant kingdom. This is because the criteria used in algal taxonomy have changed so much during the last 200 years and because the majority of the earlier descriptions are inadequate for purposes of identification.

Location of algal type specimens has been made easier by recently published lists indicating the present location of some of the classical herbaria. Unfortunately, many of the older herbaria are widely distributed and the extent of the dispersion is not yet fully realized. For this reason, previous designations of type specimens should be regarded with caution, as in many instances the designator has overlooked other specimens which are equally eligible for consideration. The failure to locate a specimen may result from the dispersion of the original herbarium, although occasionally a specimen may have been filed in its correct taxonomic position in the herbarium, whereas nomenclaturally it has been associated with another species or even another genus. Changes of interpretation between an author's successive publications, as for instance between the two editions of Hudson's *Flora Anglica*, is a constant source of confusion, although this problem is still not fully appreciated. Obviously, a consideration of what is written on a specimen is of critical importance, and it is to be regretted that so few of the older authors annotated their specimens adequately.

Algal typification is apt to be tedious and laborious, and, although it is by no means difficult, there are numerous traps and pitfalls for the unwary. An immense amount of careful typification will have to be undertaken before the publication of the proposed *Flora of British Marine Algae*, which has been one of the primary aims of this Society ever since its foundation.

7. The typification of *Fucus spiralis* L.

H. T. Powell

The correct name to be applied to the common alga we now know as *Fucus spiralis* L. was the subject of a disagreement between Börgesen and Sauvageau some 50 or so years ago. Börgesen (1902, 1909) upheld the name *F. spiralis* L. and quoted a Linnaean Herbarium specimen in support of his case; Sauvageau (1908, 1909) used the name *F. platycarpus* Thuret (dating from 1851), maintaining that nothing certain could now be known about Linnaeus's *F. spiralis* whereas Thuret's *F. platycarpus* was very exactly defined. Börgesen's conclusions have gradually become accepted by most phycologists.

I have been permitted by the Linnaean Society to make a critical examination of all the specimens of *Fucus* in Herb. Linn. and have found that the specimen that Börgesen cited as a true representative of *F. spiralis* is in fact a plant close to *F. vesiculosus* L. (with unisexual conceptacles and a few vesicles present). Börgesen had not been permitted to section receptacles and apparently overlooked the inconspicuous vesicles.

I feared at first that, because of this finding and because Linnaeus's diagnosis of *F. spiralis* is, to say the least, rather indefinite, it might be necessary to abandon the name after all, but I have learned that there is fairly strong evidence that the specimen in question was not in Herb. Linn. when Linnaeus published *Species Plantarum* (1753); it seems probable that he acquired the specimen sometime between publications in 1763 and 1767. There is therefore no case for regarding as type material the sheets labelled "*spiralis*" in Herb. Linn. However, in *Species Plantarum* the diagnosis for *F. spiralis* is followed by several references to earlier publications, and Linnaeus quotes as a synonym an entity named "*Fucus spiralis maritimus major*" in Edition 3 of the *Synopsis* by John Ray (1724). The plants on which this entity is based are at present in Herb. Sherard at Oxford, and I have established that they are true *F. spiralis* as at present understood; these plants can be used as an acceptable basis for the species *Fucus spiralis* L.

F. sherardii Stackhouse (*Nereis Britannica*, 1801) and *F. platycarpus* Thuret are both true synonyms of *F. spiralis* L.; but it should be noted that *platycarpus* Thur. is illegitimate as a specific epithet for this taxon because it is a later homonym of *Fucus platycarpus* Turner (*Fuci*, Vol. 3, 1811), which is the red alga now known as *Botryoglossum platycarpum* (Turner) Kützing.

References

Börgesen, F., 1902. Marine algae. *Botany of the Faeroes*, Part II, 339–532. Copenhagen (1903). (Issued separately.)

Börgesen, F., 1909. *Fucus spiralis* Linné or *Fucus platycarpus* Thuret: a question of nomenclature. *J. Linn. Soc.* (*Bot.*), **39**, 105–119.

Sauvageau, C., 1908. Sur deux *Fucus* récoltés à Arcachon (*Fucus platycarpus* et *F. lutarius*). *Trav. Lab. Soc. sci. Arcachon*, Année **11**, 65–224.

Sauvageau, C., 1909. Une question de nomenclature botanique, *Fucus platycarpus* ou *Fucus spiralis*. *Bull. Soc. sci. Arcachon*, Année **12**, 291–295.

8. Desmids and *Chlorella* in experimental culture.

J. Nizam

Experimental culture of certain species of desmids, particularly of *Staurastrum gracile*, *Cosmarium cucumis* and *C. subtumidum*, obtained from the Cambridge culture collection, showed that when different concentrations of KNO_3 and K_2HPO_4 were added to dilute peat extract the optimum concentrations were in the neighbourhood of those used in Waris' solution. Optimum temperature was 20–22°C., although one species survived 0°C. for nine days on an agar slope.

Fixation throughout 24 hours showed that there was a marked peak of mitosis during the dark period, even when this was given during the day with artificial illumination at night. The total mitosis under these conditions was higher than in continuous illumination.

Irradiation by large doses of β-rays showed that the desmids, like *Spirogyra*, *Zygnema* and *Mougeotia*, are strongly resistant, a proportion of cells surviving 70,000 rads. As in *Spirogyra*, chromosome fragments continued to participate in mitosis and were not lost. The most radiation-resistant organism was, however, *Chlorella pyrenoidosa*. A proportion of cells of this alga survived 2,000,000 rads administered in two doses—the highest dose of radiation known to have been survived by a living organism. Chromosomes in *Chlorella* were too small to count. High doses of U.V. were also survived. Preliminary evidence of a recovery process was obtained.

Summary by M. B. E. Godward

9. An underwater study of the epiphytes of *Laminaria hyperborea* (Gunn.) Fosl.

W. Marshall

During November 1958, a collection of *Laminaria hyperborea* stipes from different depths was made at St. Abbs in Berwickshire, by means of aqualung. The distribution of epiphytes present and their percentage cover were noted. Altogether 24 species of algae were found as epiphytes—4 green, 4 brown, and 16 red. Four major species were found: *Rhodymenia palmata*, *Phycodrys rubens*, *Membranoptera alata*, and *Ptilota plumosa*. A most striking relationship was found between *Rhodymenia palmata* and *Phycodrys rubens*: near the surface *Rhodymenia palmata* occurred along the entire length of the stipe but was found to occupy the distal parts of the stipe with increasing depth, leaving *Phycodrys rubens* to occupy the vacated portions. However, at intermediate depths where *Rhodymenia palmata* and *Phycodrys rubens* were at their minimum cover, it was noted that *Ptilota plumosa* and *Membranoptera alata* had their maximum cover. Indeed at this point, approximately 16 ft. below M.L.W.S., the maximum number of species occurred. It would seem that the mirror-image distribution of *Rhodymenia palmata* and *Phycodrys rubens* is due to their light/shade preferences, while the influx of species at intermediate depths is probably due to lack of competition from *Rhodymenia palmata* and *Phycodrys rubens*.

Certain species were found only at depths; these were *Plocamium coccineum*, *Pterosiphonia parasitica*, *Odonthalia dentata*, *Callophyllis laciniata*, *Ptilothamnion pluma*, *Delesseria sanguinea*, *Plumaria elegans*. It is interesting to note the occurrence of some green algae at considerable depths, *Chaetomorpha melagonium* being found 23 ft. below M.L.W.S. This study indicates that it might be possible to use the epiphytes present on cast stipes as indicators of the depth from which the stipe came.

In studying the epiphyte-host relations, an attempt was made to remove the epiphytes from the host stipe by means of chemicals, but this was unsuccessful. Sections of the epiphyte holdfast attached to the host showed very intimate contact between the cells of the two species, and in the case of *Ptilota plumosa* the cells penetrated the host tissue to a considerable extent.

10. Observations on sublittoral Antarctic marine algae.

M. Neushul

Intertidal collecting in Antarctica is generally impossible owing to the abrasive action of floating ice in the exposed areas and shallow waters. Further difficulties are encountered in places where glaciers extend out directly into the water, leaving no intertidal zones exposed. The use of the dredge by Skottsberg (1906) provided the first indication that rich growths of marine algae can occur off the shores of the Antarctic continent.

The successful use of self-contained underwater breathing apparatus, or " scuba " as it is called by Bascom and Revelle (1953), and the development of exposure suits for use in cold water has led to considerable use of this tool for marine biological studies in temperate waters. Combinations and modifications of different types of diving gear were tried in the South Shetland Islands and the Bellingshausen Sea in an attempt to determine if this technique could be used in these extremely cold Antarctic waters. Thirty-three dives were made in water ranging from 1°C. to − 1·5°C. The longest continuous period spent in the water was slightly over one hour, the longest continuously submerged time being 45 minutes. Dives were made to depths down to 20 metres. The best exposure suit from the point of view of mobility, warmth and general comfort was a wet-type foam-neoprene suit. This was used with snorkle, compressed air and oxygen re-breathing types of air supply.

Luxuriant plant growths were observed growing below the level of ice action. Preliminary morphological studies of several of the dominant brown algal components of the flora have yielded surprising results. The occurrence of unusual reproductive organs and developmental vegetative characters indicate the existence of plants that do not fit into the currently accepted brown algal taxonomic groups.

REFERENCES

Bascom, W. N., and Revelle, R., 1953. Free diving: a new exploratory tool. *Amer. Scient.*, **41**, 624–627.
Skottsberg, C., 1906. Observations on the vegetation of the Antarctic Sea. *Bot. Stud. till F.R. Kjellman, Uppsala*, 245–264.

ALGAL SPECIES LISTS

LIST OF ALGAE COLLECTED ON THE NORTHUMBERLAND COAST

August, 1959

The names in this list are given in the same order as in Parke's check-list (1953, 1956, 1957, 1959). The places where collections were made are identified in the list by numbers as follows: (1) Monks' House Rocks; (2) Budle Bay saltmarsh; (3) Beadnell Bay; (4) The Outer Farnes; (5) Holy Island; (6) Berwick-on-Tweed; (7) Alnmouth; (8) Boulmer.

Specimens of the very common species were not preserved; specimens of the majority of the species recorded in this list have been placed in the herbarium of the Marine Laboratory at Plymouth.

Chlorophyta

Brachiomonas submarina Bohlin
4; supra-littoral pools.
Enteromorpha compressa (L.) Grev.
1, 3, 4, 5, 6, 8; mid and lower littoral.
Enteromorpha intestinalis (L.) Link
5, 7; littoral.
Enteromorpha prolifera (Müll.) J. Ag.
4; lower littoral.
Ulva lactuca L.
1, 3, 4, 5, 6, 8; littoral.
Prasiola stipitata Suhr
4, 8; supra-littoral.
Acrosiphonia centralis (Lyngb.) Kjellm.
4; lower littoral.
Chaetomorpha aerea (Dillw.) Kütz.
3, 4, 6; mid and lower littoral pools.
Chaetomorpha capillaris (Kütz) Börg.
6; lower littoral.
Chaetomorpha melagonium (Web. et Mohr) Kütz.
5, 8; mid and lower littoral pools.
Cladophora albida (Huds.) Kütz.
1; lower littoral.
Cladophora rupestris (L.) Kütz.
1, 3, 4, 5, 6, 8; littoral.
Rhizoclonium implexum (Dillw.) Kütz.
2; mid and lower littoral.
Bryopsis plumosa (Huds.) Ag.
5; lower littoral pools.
Codium fragile (Sur.) Hariot subsp. *atlanticum* (Cotton) Silva
3; mid littoral pools.

Phaeophyta

Ectocarpus fasciculatus Harv.
5, 6; littoral.
Ectocarpus siliculosus (Dillw.) Lyngb.
5, 6; littoral.
Feldmannia simplex (Crn.) Hamel
4; littoral.
Giffordia granulosa (Sm.) Hamel
5; lower littoral and sub-littoral.
Pylaiella littoralis (L.) Kjellm.
4, 5, 6, 8; littoral.
Spongonema tomentosum (Huds.) Kütz.
4, 6; mid and lower littoral.
Ralfsia verrucosa (Aresch.) J. Ag.
6; lower littoral.
Elachista flaccida (Dillw.) Aresch.
6, 8; littoral pools.
Elachista fucicola (Vell.) Aresch.
3, 4, 6, 8; mid and lower littoral.
Elachista scutulata (Sm.) Duby
3, 4; lower littoral.
Leathesia difformis (L.) Aresch.
3, 4, 5, 6, 8; littoral.
Chordaria flagelliformis (Müll.) Ag.
3, 4, 6, 8; mid and lower littoral pools.
Eudesme virescens (Carm.) J. Ag.
3, 6; upper littoral pools.
Mesogloia vermiculata (Sm.) S. F. Gray
5, 7; mid and lower littoral pools and sub-littoral.
Myriotrichia clavaeformis Harv.
1; mid littoral pools.
Litosiphon laminariae (Lyngb.) Harv.
3, 4; lower littoral and sub-littoral.
Litosiphon pusillus (Carm.) Harv.
5; lower littoral and sub-littoral.
Punctaria latifolia Grev.
5; lower littoral.
Asperococcus fistulosus (Huds.) Hook.
6, 8; mid littoral pools.

Dictyosiphon foeniculaceus (Huds.) Grev.
3, 4; littoral pools.
Colpomenia peregrina Sauv.
5, 6; littoral.
Scytosiphon lomentaria (Lyngb.) Endl.
1, 3, 4, 5, 6, 7, 8; mid littoral pools and lower littoral.
Desmarestia aculeata (L.) Lamour.
1, 6, 8; drift. 3, 4, 5; sub-littoral.
Desmarestia ligulata (Lightf.) Lamour.
3, 5, 6; drift. 1; sub-littoral.
Desmarestia viridis (Müll.) Lamour.
3, 5, 6; lower littoral pools and sub-littoral.
Chorda filum (L.) Stackh.
3, 4, 5, 7, 8; lower littoral pools and sub-littoral.
Laminaria digitata (Huds.) Lamour.
1, 3, 4, 5, 6; pools and sub-littoral.
Laminaria hyperborea (Gunn.) Fosl.
3, 4, 5, 6, 8; sub-littoral.
Laminaria saccharina (L.) Lamour.
3, 4, 5, 6, 8; pools and sub-littoral.
Saccorhiza polyschides (Lightf.) Batt.
5; sub-littoral. Also in drift in Seahouses harbour.
Alaria esculenta (L.) Grev.
1, 3, 4, 5, 6; sub-littoral.
Sphacelaria bipinnata (Kütz.) Sauv.
5, 6, 8; littoral pools.
Sphacelaria pennata (Huds.) Lyngb.
6, 8; mid and lower littoral.
Sphacelaria plumosa Lyngb.
5; sub-littoral.
Halopteris scoparia (L.) Sauv.
7; mid littoral pools.
Cladostephus spongiosus (Huds.) Ag.
1, 3, 4, 5, 6, 8; lower littoral.
Dictyota dichotoma (Huds.) Lamour.
3, 5, 6; mid and lower littoral pools and sub-littoral.
Ascophyllum nodosum (L.) Le Jol.
3, 4, 5, 6, 8; mid littoral.
Fucus ceranoides L.
7; littoral.
Fucus serratus L.
1, 3, 4, 5, 6, 8; lower littoral.
Fucus spiralis L.
1, 3, 4, 5, 6, 8; upper littoral.
Fucus vesiculosus L.
3, 4, 5; mid and lower littoral.
Pelvetia canaliculata (L.) Dcne. et Thur.
2, 3, 4, 5, 8; upper littoral.
Himanthalia elongata (L.) S. F. Gray
3, 4, 6, 8; lower littoral.
Halidrys siliquosa (L.) Lyngb.
3, 4, 5, 6, 8; littoral pools and sub-littoral.

Rhodophyta

Porphyra umbilicalis (L.) Kütz.
3, 4, 5, 6, 8; littoral.
Acrochaetium bonnemaisoniae (Batt.) J. et G. Feldm.
1; drift.
Acrochaetium virgatulum (Harv.) J. Ag.
1, 3, 4, 5; lower littoral.
Rhodochorton floridulum (Dillw.) Näg.
3, 4, 5, 6, 8; littoral.
Nemalion multifidum (Web. et Mohr) J. Ag.
3, 4; lower littoral.
Gelidium pulchellum (Turner) Kütz., sensu Feldm. et Hamel.
8; lower littoral.
Furcellaria fastigiata (L.) Lamour.
4, 5, 6, 8; lower littoral pools and sub-littoral.
Cystoclonium purpureum (Huds.) Batt.
1, 3, 4, 5, 6, 8; lower littoral.
Plocamium coccineum (Huds.) Lynbg.
3, 4, 5, 6, 8; lower littoral pools and sub-littoral.
Gracilaria verrucosa (Huds.) Papenf.
5, 8; lower littoral pools and sub-littoral.
Ahnfeltia plicata (Huds.) Fries
1, 3, 5, 6, 8; lower littoral pools and sub-littoral.
Phyllophora membranifolia (Good. et Woodw.) J. Ag.
5; sub-littoral.
Phyllophora rubens (L.) Grev.
3, 4, 5; lower littoral pools and sub-littoral.
Chondrus crispus (L.) Stackh.
1, 3, 4, 5, 6, 8; lower littoral.
Gigartina stellata (Stackh.) Batt.
1, 3, 4, 5, 6, 8; lower littoral.
Dilsea carnosa (Schmidel) Kuntze
3, 4, 5, 6, 8; sub-littoral.
Dumontia incrassata (Müll.) Lamour.
3, 5, 6, 8; mid and lower littoral.
Polyides rotundus (Huds.) Grev.
3, 4, 5, 6, 8; lower littoral pools.
Hildenbrandia prototypus Nardo
8; lower littoral.
Corallina officinalis L.
3, 4, 5, 6, 8; littoral pools and lower littoral.
Halymenia latifolia Crn.
1, 3; drift.
Callophyllis laciniata (Huds.) Kütz.
3, 6; lower littoral pools.
Kallymenia reniformis (Turn.) J. Ag.
5, 8; drift. 6; lower littoral pools.

Rhodophyta—*continued*

Bonnemaisonia asparagoides (Woodw.) Ag.
1, 3, 5, 6; drift.
Lomentaria articulata (Huds.) Lyngb.
3, 5, 6, 8; lower littoral.
Lomentaria clavellosa (Turn.) Gaill.
3, 5; lower littoral. 6; drift.
Rhodymenia palmata (L.) Grev.
1, 3, 4, 5, 6, 8; lower littoral and sub-littoral.
Antithamnion plumula (Ellis) Thur.
1; drift.
Callithamnion arbuscula (Dillw.) Lyngb.
4; lower littoral.
Callithamnion hookeri (Dillw.) Ag.
3; lower littoral.
Callithamnion tetragonum (Wither.) Ag.
1; lower littoral.
Ceramium acanthonotum (Carm. ex Harv.) J. Ag.
4, 6; lower littoral.
Ceramium rubrum (Huds.) Ag.
3, 4, 5, 6, 8; littoral.
Griffithsia flosculosa (Ellis) Batt.
3, 5, 6, 8; lower littoral pools.
Plumaria elegans (Bonnem.) Schm.
3, 4, 6, 8; lower littoral and sub-littoral.
Ptilota plumosa (Huds.) Ag.
3, 4, 5, 6, 8; sub-littoral.
Cryptopleura ramosa (Huds.) Kylin
4, 5, 6, 8; lower littoral pools.
Delesseria sanguinea (Huds.) Lamour.
3, 4, 5, 6, 8; lower littoral pools and sub-littoral.
Membranoptera alata (Huds.) Stackh.
3, 4, 5, 6, 8; lower littoral and sub-littoral.
Phycodrys rubens (Huds.) Batt.
3, 4, 6, 8; lower littoral pools and sub-littoral.
Brongniartella byssoides (Good. et Woodw.) Schm.
3; drift. 8; littoral pools.
Laurencia hybrida (D.C.) Lenorm. ex Duby
5, 6, 8; lower littoral.
Laurencia pinnatifida (Huds.) Lamour.
3, 4, 5, 6, 8; lower littoral.
Odonthalia dentata (L.) Lyngb.
1, 3, 4, 8; sub-littoral.
Polysiphonia brodiaei (Dillw.) Grev.
4; lower littoral.
Polysiphonia elongata (Huds.) Harv.
5, 6, 8; lower littoral pools.
Polysiphonia lanosa (L.) Tandy
3, 4, 6, 8; mid littoral.
Polysiphonia nigra (Huds.) Batt.
5; lower littoral pools.
Polysiphonia nigrescens (Sm.) Grev.
3, 5, 6, 8; lower littoral.
Polysiphonia urceolata (Dillw.) Grev.
4, 6; lower littoral.
Rhodomela confervoides (Huds.) Silva
3, 4, 6; lower littoral pools.
Rhodomela lycopodioides (L.) Ag.
1, 3, 6; lower littoral pools and sub-littoral.

Myxophyta

Calothrix confervicola (Roth) C. Ag. ex. Born. et Flah. 8; upper littoral pools.

References

Parke, M. W., 1953. A preliminary check-list of British marine algae. *J. mar. biol. Ass. U.K.*, **32**, 497–520.
Parke, M. W., 1956. A preliminary check-list of British marine algae; corrections and additions, 1953–5. *Brit. phycol. Bull.*, **1** (4), 26–31.
Parke, M. W., 1957. A preliminary check-list of British marine algae; corrections and additions, II. *Brit. phycol. Bull.*, **1** (5), 36–7.
Parke, M. W., 1959. A preliminary check-list of British marine algae; corrections and additions, III. *Brit. phycol. Bull.*, **1** (7), 74–78.

References to the marine algae of the districts visited are contained in the following papers:

Batters, E. A. L., 1889. A list of the marine algae of Berwick-on-Tweed. *Proc. Berwicksh. Nat. Cl.*, **12**, 221–392.
Moss, B., 1957. Codium on the coast of Northumberland. *Brit. phycol. Bull.*, **1** (5), 40.
Moss, B., 1959. Marine algae of the Inner Farne. *Trans. nat. Hist. Soc. Northumb.*, **13**, 101–119.

W. Eifion Jones

Marine Biology Station,
Menai Bridge,
Anglesey, N. Wales

A PRELIMINARY LIST OF THE MARINE ALGAE OF THE GALLOWAY COAST

A list of 46 species of algae found between Girvan and Burrow Head on the coasts of Ayrshire and Wigtownshire in May and June, 1943, was published in a Ministry of Supply supplement to H.M.S.O. monograph entitled " A study of certain British seaweeds and their utilisation in the preparation of agar," edited by L. Newton. Apart from this, however, there appear to be no published records of algae from the Galloway region of the British coast. The following preliminary list of algae found on the coasts of Kirkcudbrightshire and Wigtownshire is based on three short visits made in July, 1957, September, 1958, and April, 1959. Collections were made at a number of localities from Sutherness Lighthouse along the Solway Firth to the Mull of Galloway, and also at one point on the west coast of the Rinns of Galloway. The localities are named and numbered as follows: (1) Sutherness Lighthouse; (2) Auchencairn Bay ; (3) Balacary Point; (4) Ross Bay; (5) Brighouse Bay; (6) Kirkandrews; (7) Mossyard; (8) Isle of Whithorn; (9) East Tarbot, Mull of Galloway; (10) West Tarbot, Mull of Galloway; (11) Genoch Rocks, Rinns of Galloway.

No attempt is made here to discuss ecological problems associated with the distributions of algae found, and only species for which identification is reasonably certain are given. Drift specimens have been included only where their fresh condition and quantity suggested a sublittoral source not far away from the locality in which they were found. Fruiting records, where given, are merely intended to imply that, at the time of collection, plants were found to be in the condition stated ; they give no indication of the maximum fruiting period for the species concerned.

Except in certain cases to which attention is drawn, the order of species and the nomenclature follow Parke (1953, 1956, 1957 and 1959).

Herbarium specimens and fixed material of the species recorded, and also of those not yet identified, have been deposited in the herbarium of the Botany Department of the University of Liverpool.

I am indebted to Dr P. S. Dixon for help, especially in the identification of some of the species of Rhodophyta.

Chlorophyta

Chlorochytrium willei Printz
5, 6, 9.
Ulothrix flacca (Dillw.) Thur.
7, 8.
Ulothrix pseudoflacca Wille
7, 8.
Monostroma sp.
7, 8, 11.
Blidingia minima (Näg.) Kylin
5, 6, 8, 9, 11.
Enteromorpha clathrata (Roth) Grev.
1, 7, 9, 11.
Enteromorpha compressa (L.) Grev.
1, 2, 3, 4, 5, 6, 7, 9, 11.
Enteromorpha intestinalis (L.) Link
1–11.
Enteromorpha linza (L.) J. Ag.
6, 8.
Ulva lactuca L.
1–11.
Prasiola stipitata Suhr
11.
Chaetomorpha melagonium (Web. et Mohr) Kütz.
5, 6.
Chaetomorpha linum (Müll.) Kütz.
7, 11.
Cladophora rupestris (L.)
1–11.
Cladophora spp.
1–11.
Rhizoclonium riparium (Roth) Harv. f. *validum* Foslie
(see Koster, 1955)
5, 6, 7, 8, 9, 11.

Chlorophyta—*continued*

Spongomorpha arcta (Dillw.) Kütz.
11.
Bryopsis hypnoides Lamour.
5, 7, 8, 9.
Bryopsis plumosa (Huds.) Ag.
5, 7, 8, 9, 11.
Codium fragile (Sur.) Hariot subsp. *atlanticum* (Cotton) Silva
5, 6, 8, 11.
Codium fragile (Sur.) Hariot subsp. *tomentosoides* (van Goor) Silva
6, 11.

Phaeophyta

Pylaiella littoralis (L.) Kjellm.
1, 4, 5, 6, 7, 8, 9, 11. Unilocular sporangia, September.
Elachista fucicola (Vell.) Aresch.
6, 7, 8, 9, 11.
Cylindrocarpus berkeleyi (Grev.) Crn.
9.
Leathesia difformis (L.) Aresch.
8, 9.
Chordaria flagelliformis (Müll.) Ag.
6, 8, 9.
Punctaria sp.
11.
Asperococcus sp.
11.
Dictyosiphon foeniculaceus (Huds.) Grev.
8, 11.
Colpomenia peregrina Sauv.
8, 11.
Scytosiphon lomentaria (Lyngb.) Endl.
1, 7, 8, 9, 11.
Desmarestia aculeata (L.) Lamour.
5, 9; drift.
Chorda filum (L.) Stackh.
5.
Laminaria digitata (Huds.) Lamour.
6, 8, 10, 11.
Laminaria hyperborea (Gunn.) Fosl.
7, 8, 11.
Laminaria saccharina (L.) Lamour.
6, 7, 8, 10, 11.
Alaria esculenta (L.) Grev.
8, 11.
Chaetopteris plumosa (Lyngb.) Kütz.
5; drift.
Sphacelaria pennata (Huds.) Lyngb.
8, 10. (See Irvine, 1955.)
Cladostephus spongiosus (Huds.) Ag.
1, 6, 9.
Dictyota dichotoma (Huds.) Lamour.
5, 6, 7, 8, 10, 11.
Taonia atomaria (Woodw.) J. Ag.
Drift. Tetrasporangia, July.
Ascophyllum nodosum (L.) Le Jol.
1, 2, 5, 6, 7, 8, 9, 11.
Fucus serratus L.
5–11.
Fucus spiralis L.
1–11.
Fucus vesiculosus L.
1–11.
Fucus vesiculosus L. f. *linearis* (Huds.) Powell
6, 7, 8, 11.
Pelvetia canaliculata (L.) Dcne. et Thur.
1, 5, 6, 7, 8, 10, 11.
Himanthalia elongata (L.) S. F. Gray
10.
Halidrys siliquosa (L.) Lyngb.
6, 7, 8, 11.

Rhodophyta

Porphyra sp.
1, 5, 6, 7, 8, 10, 11.
Acrochaetium sp.
8.
Gelidium latifolium (Grev.) Born. et Thur. (See Feldmann and Hamel, 1936.)
8, 10. Spermatia, carposporophytes and tetrasporangia, September.
Gelidium pulchellum (Turn.) Kütz.
6. (See Feldmann and Hamel, 1936.)
Furcellaria fastigiata (L.) Lamour.
3, 6, 7, 8, 11.
Catanella repens (Lightf.) Batt.
8.
Calliblepharis lanceolata (Stackh.) Batt.
3.
Cystoclonium purpureum (Huds.) Batt.
6, 8, 9, 10, 11. Carposporophytes and tetrasporangia, September.
Plocamium coccineum (Huds.) Lyngb.
5, 9; drift.
Gracilaria verrucosa (Huds.) Papenf.
9; drift.
Ahnfeltia plicata (Huds.) Fries
7, 9, 10.
Phyllophora membranifolia (Good. et Woodw.) J. Ag.
7, 8, 9, 11.
Chondrus crispus (L.) Stackh.
7, 8, 9, 10, 11. Carposporophytes, April and September.
Gigartina stellata (Stackh.) Batt.
1, 5, 6, 7, 8, 10, 11. Carposporophytes, April and September.

Rhodophyta—*continued*

Dilsea carnosa (Schmidel) Kuntze
3, 5, 9, 11 ; drift.
Dumontia incrassata (Müll.) Lamour.
1, 7, 8, 11.
Polyides caprinus (Gunn.) Papenf.
10.
Corallina officinalis L.
4, 5, 6, 7, 8, 9, 10, 11.
Callocolax neglectus Schm.
9 ; drift.
Callophyllis laciniata (Huds.) Kütz.
9 ; drift.
Bonnemaisonia asparagoides (Woodw.) Ag.
3 ; drift. Sexual.
Trailliella intricata Batt.
11.
Chylocladia verticillata (Lightf.) Bliding
10, 11. Tetrasporangia, September.
Lomentaria articulata (Huds.) Lyngb.
5, 6, 7, 8, 10, 11.
Rhodymenia palmata (L.) Grev.
7, 8, 10, 11. Tetrasporangia, September.
Callithamnion arbuscula (Dillw.) Lyngb.
11.
Ceramium ciliatum (Ellis) Ducluz.
10.
Ceramium diaphanum (Roth) Harvey/*Ceramium strictum* (Kütz.) Harv.
11. (See Feldmann-Mazoyer, 1940.)
Ceramium flabelligerum J. Ag.
10, 11. Spermatia and tetrasporangia, Sept.
Ceramium rubrum (Huds.) Ag.
1, 7, 9, 10, 11.
Ceramium pedicellatum (Duby) J. Ag.
10. Tetrasporangia, September.
Ceramium shuttleworthianum (Kütz.) Silva (= *C. acanthonotum* (Carm. ex Harv.) J. Ag.)
11.
Griffithsia flosculosa (Ellis) Batt.
5, 6, 9, 10, 11. Spermatia and tetrasporangia, September.
Plumaria elegans (Bonnem.) Schm.
6, 7, 8, 9, 10, 11.
Ptilota plumosa (Huds.) Ag.
9, 11 ; drift.
Cryptopleura ramosa (Huds.) Kylin
10 ; drift.
Delesseria sanguinea (Huds.) Lamour.
11.
Hypoglossum woodwardii Kütz.
11. Carposporophytes, April.
Membranoptera alata (Huds.) Stackh.
6, 8, 9, 11. Tetrasporangia, April.
Phycodrys rubens (Huds.) Batt.
7, 8, 9 ; and other localities as drift.
Heterosiphonia plumosa (Ellis) Batt.
3 ; drift.
Bostrychia scorpioides (Huds.) Mont.
2.
Brongniartella byssoides (Good. et Woodw.) Schm.
5 ; drift.
Laurencia hybrida (D.C.) Lenorm. ex Duby
6, 7, 8, 11.
Laurencia pinnatifida (Huds.) Lamour.
3, 5, 6, 7, 8, 9, 11.
Odonthalia dentata (L.) Lyngb.
8, 11.
Polysiphonia brodiaei (Dillw.) Grev.
11. Carposporophytes and tetrasporangia, April.
Polysiphonia elongata (Huds.) Harv.
11 ; other localities as drift.
Polysiphonia nigrescens (Sm.) Grev.
5.
Polysiphonia urceolata (Dillw.) Grev.
10, 11.
Polysiphonia violacea (Roth) Grev.
11.
Rhodomela confervoides (Huds.) Silva
6, 7, 8.
Rhodomela lycopodioides (L.) Ag.
7.

REFERENCES

FELDMANN, J., and HAMEL, G., 1936. Floridées de France, VII. Gélidiales. *Rev. algol.*, **9**, 209–264.

FELDMANN-MAZOYER, G., 1940. *Recherches sur les Céramiacées de la Méditerranée Occidentale.* Alger.

IRVINE, D. E. G., 1955. Notes on British species of the genus *Sphacelaria* Lyngb. *Trans. bot. Soc. Edinb.*, **37**, 24–45.

KOSTER, J. Th., 1955. The genus *Rhizoclonium* Kütz. in the Netherlands. *Pubbl. Staz. zool. Napoli*, **27**, 335–357.

PARKE, M. W., 1953. A preliminary check-list of British marine algae. *J. mar. biol. Ass. U.K.*, **32**, 497–520.

PARKE, M. W., 1956. A preliminary check-list of British marine algae ; corrections and additions, 1953–55. *Brit. phycol. Bull.*, **1** (4), 26–31.

PARKE, M. W., 1957. A preliminary check-list of British marine algae ; corrections and additions, II. *Brit. phycol. Bull.*, **1** (5), 36–37.

PARKE, M. W., 1959. A preliminary check-list of British marine algae ; corrections and additions, III. *Brit. phycol. Bull.*, **1** (7), 74–78.

E. M. BURROWS

Dept. of Botany,
University of Liverpool

MARINE BLUE-GREEN ALGAE FROM THE ISLAND OF BARRA (OUTER HEBRIDES)

An account of the marine algae of Barra was given in 1938 by Sinclair, but he recorded no members of the Myxophyceae. The present list is offered as an addition to our knowledge of the marine flora of the Hebrides.

Collections were made in September, 1959, mainly from the following points on the island: (1) Grean; (2) Cliad; (3) Traigh mhor; (4) Traigh scurrival; (5) Halaman Bay; (6) Bay Hirivagh; (7) Cliffs north of Cliad.

List of Species

Chroococcus turgidus (Kütz.) Näg. (*Anacystis dimidiata* Drouet and Daily).

Cells solitary or in pairs, spherical, protoplasm bright green, 15 μ in diam. without sheath. Sheath 5 μ broad, hyaline.

Uncommon in upper littoral (3).

Holopedia sabulicola (Lagerh.) Kirchn. (*Agmenellum quadruplicatum* Brébisson, in Drouet and Daily).

Colonies 55 × 30 μ in size, composed of flat plate of cells. Cells spherical, ellipsoidal or cylindrical, 2·5–3 × 3 μ in diam., irregularly arranged. Cell division in two planes. Sheath hyaline.

Rare among shell grit and mud, upper littoral (3).

Entophysalis granulosa Kütz. (*Entophysalis deusta* Drouet and Daily).

Thallus encrusting dark brown or black in colour. Colonies 100–150 μ in diam., composed of polygonal cells 3–4 μ in diam. Sheath thick, often lamellate, brown in colour.

Widespread on limpet and cockle shells (2, 3, 4, 5, 6, 7).

Oncobyrsa marina (Grun.) Rabenh. (*Entophysalis conferta* Drouet and Daily).

Colonies ranging in size from 25 × 40 μ to 40 × 60 μ. Cells aggregated mainly in twos and fours; within distinct mucilaginous sheath. Outer cells ellipsoidal (3–5 μ broad), inner cells curved (2 × 5 μ). Cell division occurring in three planes.

Uncommon epiphyte on *Cladophora rupestris*, *Calothrix scopulorum* and other small algae (7).

Lyngbya rivulariarum Gom.

Filaments torulose; trichomes 0·7–1·2 μ in diam. Cells twice as long as broad, protoplasm homogeneous. No narrowing at rounded apices. Sheath thin.

Common within the mucilage sheaths of *R. atra* and endophytic within cells on several occasions. Probably widespread (1).

Lyngbya infixa Frémy.

Filaments flexuose; trichomes 1·2–2 μ in diam. Cells square or slightly shorter than broad. Apices rounded, no distinct narrowing at septae.

Common epiphyte on *Cladophora rupestris* in mid-tidal pools. Epiphytic on *Dilsea edulis* on one occasion (2, 5).

Lyngbya epiphytica Hieron.

Trichomes 1·5 μ in diam. Cells slightly shorter than broad. Apices rounded, no narrowing at septae.

Common, forming a weft round the filaments of *Cladophora rupestris* (1, 2).

Lyngbya contorta Lemm.

Filaments forming a loose spiral. Trichomes 0·8–1·2 μ in diam. Cells 1½ times longer than broad. No narrowing at septae. Apices rounded. Sheath thin.

Rare in supralittoral, among mud where fresh water comes in (3).

Phormidium fragile Gom.

Filaments flexuose, trichomes 1·25–1·75 μ in diam. Cells slightly longer than broad. Septae not easily visible. Protoplasm homogeneous. No narrowing at septae.

Fairly common among *Polysiphonia urceolata*, and rarely on *Cladophora rupestris* in pools in lower littoral (2).

Phormidium molle Gom.

Filaments flexuose, trichomes 1·5–2 μ in diam. Cells twice as long as broad; protoplasm homogeneous. Tapering at apex, no narrowing at septae.

Uncommon among sand and cockle grit in littoral (3, 4).

Phormidium corium (Ag.) Gom.

Filaments flexuose. Trichomes 3–4 μ in diam. Cells twice as long as broad. Protoplasm homogeneous. Slightly attenuated at rounded apices. No narrowing at septae.

Uncommon among *Rivularia atra*. var. *hemisphaerica* (2, 7).

Plectonema nostocorum Born. ex Gom.

Filaments falsely branched. Trichomes 1·25–1·75 μ in diam. Cells square or slightly longer than broad. Apices rounded, slightly narrowing at septae. Protoplasm homogeneous.

Fairly common among gelatinous sheaths of *Rivularia atra.* var. *confluens* (1, 2).

Oscillatoria nigro-viridis Thwaites ex Gom.

Filaments torulose, trichomes 7–8 μ in diam. Cells three times shorter than broad. Protoplasm bright olive green; lining of granules on either side of septae. No narrowing at septae; apices rounded.

Uncommon, among *Calothrix scopulorum* and *C. crustaceae* on shells and small pebbles among mud in littoral (3).

Oscillatoria tenuis Ag.

Filaments free, trichomes 4 μ in diam. Cells 2–2½ times shorter than broad. Slight narrowing at septae. No tapering towards the rounded apex. Protoplasmic granules lining either side of septae.

Uncommon among smaller algae, in brackish upper littoral pools (3).

Oscillatoria amphibia Ag. ex. Gom.

Filaments straight, trichomes 2·5–3·0 μ in diam. Cells twice as long as broad; two granules on either side of septae. Apices rounded; no narrowing at septae.

Rare among smaller algae in mid-littoral pools (2).

Oscillatoria brevis Kütz. ex. Gom.

Filaments free, trichomes 4–5 μ in diam. Cells 2½–3 times shorter than broad. Protoplasm granular, tapering slightly at curved apex; no narrowing at septae.

Uncommon among *Cladophora* sp. in mid-littoral pools (2).

Spirulina subsalsa Oersted ex. Gom. f. *oceanica* Gom.

Spiral closely twisted 2 μ apart, 3·5–4·0 μ broad. Trichomes 1 μ in diam. Septae not easily visible. Protoplasm bright green.

Common among mud and sand in upper and mid-littoral (3, 4).

Calothrix convervicola Ag. ex. Born. et Flah.

Filaments forming fasciculate tufts. Trichomes 10–18 μ in diam., slightly thicker at base. Cells 3½–4 times shorter than broad; heterocysts basal. Sheath thick, hyaline or yellow.

Very common epiphyte on smaller algae throughout littoral (2, 3, 6).

Calothrix crustaceae Thur. ex. Born. et Flah.

Filaments tufted, sparingly branched, 12–18 μ in diam. Trichomes 8–12 μ broad, cells 3–4 times shorter than broad. Heterocysts basal and intercalary. Sheaths yellow.

Common on cockle shells in upper littoral (3).

Calothrix scopulorum (Web. et Mohr) Ag. ex. Born. et Flah.

Filaments interwoven over substratum. Trichomes 8–12 μ in diam., slightly thicker at base; terminating in hyaline hair. Basal cells square, upper cells 2–4 times shorter than broad. Protoplasm olive green. Sheath thin or thick, hyaline or yellow.

Widespread. Dominant blue-green in upper littoral (2, 3, 6, 7).

Rivularia atra Roth ex. Born. et Flah.

Colonies gelatinous, deep blue-green; trichomes 3–5 μ in diam.; falsely branched, ending in long hair. Basal cells square, upper cells shorter; heterocysts basal.

Var. *confluens*, Farlow. Forming irregular confluent mats. Sheath thick, often yellow or brown. Occurring commonly on vertical faces in supralittoral, particularly where fresh water runs in (1).

Var. *hemisphaerica* Born. et Flah. Colonies hemispherical, solitary, 1–3 mm. in diam. Trichomes closely parallel, arising from a central point. Occurring commonly in mid-littoral, particularly on *Lithothamnion* and *Hildenbrantia* (2, 3, 7).

Nodularia harveyana (Thwaites) Thus. ex. Born. et Flah.

Filaments flexuose, trichomes 4 μ in diam., cells twice as short as broad, protoplasm granular. Heterocysts subspherical, 6 μ in diam., singly or in pairs.

Rare. Among Fucoid sporelings, upper littoral (5).

REFERENCES

DROUET, F., and DAILY, W., 1956. Revision of the Coccoid Myxophyceae. *Butler Univ. bot. Stud.*, **12.**

FRÉMY, P., 1934. Cyanophycees des côtes d'Europe. *Mém. Soc. nat. Sci. Cherbourg*, **41**, 1–235.

GEITLER, L., 1932. *Cyanophyceae.* Rabenhorsts *Kryptogamen-Flora*, **14.**

LINDSTEDT, A., 1943. *Die Flora der marinen Cyanophyceen der schwedischen Westkuste.* Lund.

NEWTON, L., 1931. *A Handbook of British Seaweeds.* London.

SINCLAIR, J., 1936. Marine Algae in Natural History of Barra. *Proc. R. phys. Soc. Edinb.*, **22**, 257.

SINCLAIR, J., 1938. The Marine Algae of Barra. *Trans. bot. Soc. Edinb.*, **32**, 432–437.

W. D. P. STEWART

Dept. of Botany,
University of Glasgow

NOTES ON IMPORTANT ALGAL HERBARIA, II

THE HERBARIUM OF JOHN ELLIS (? 1710–1776)

The resurgence, in recent years, of interest in algal taxonomy has been accompanied by the realization that accurate typification is essential if names of taxa are to be applied with precision. In order to facilitate the search for nomenclatural type specimens, several important catalogues of algal herbaria and their present location have been published recently (Dickinson, 1952; Newton, 1952; Womersley, 1956; Koster, 1954, 1957, 1958, 1960). It should be realized that, with a number of the oldest and most important collections, it is not apparent how much of the original herbarium has survived, or, if it is known that the herbarium has been subdivided and incorporated into other collections, where the surviving fragments, if any, are to be found. As has been shown in relation to the herbaria of Hudson and Lightfoot (Dixon, 1959), the information available at the present time, relating to the history of the older collections, is often very fragmentary, and the statements in the literature are often misleading or contradictory. During the past year, an intensive search has been undertaken with the aim of elucidating the present whereabouts of the collections of John Ellis (? 1710–1776). Ellis was interested primarily in the animal corals or "zoophytes," although various algae were included by him in this category, and he published descriptions and illustrations of these in his various works (Ellis, 1755, 1767; Ellis and Solander, 1786). From the point of view of typification, the Ellis collections are by no means as important as those of some of the other early authors, in that the number of species involved is relatively small, but the collections are nevertheless of considerable interest and importance.

According to Newton (1952), the Ellis collections are located at the present time in three institutions, viz., Royal College of Surgeons, London; British Museum (Natural History), London; Royal Botanic Gardens, Kew. Preliminary enquiries were made at these institutions regarding the Ellis herbarium, but without success. Information was obtained to indicate that the bulk of the non-medical museum collections of the Royal College of Surgeons was transferred to the British Museum in November, 1939, but there was nothing at the latter institution to indicate that any algae had been included in that transfer. Furthermore, it must be assumed that any material which remained at the Royal College of Surgeons has been lost, as a result of the destruction of the museum of that institution by bombing in 1941. A detailed search of the algal herbaria at the British Museum (Natural History) and at Kew failed to reveal any indication of specimens that could be attributed to Ellis.

A search of relevant documents and books was then undertaken in the hope that some indirect reference to the Ellis collections could be obtained. The most complete source of information relating to Ellis is the biography written by Smith (1809*), who appears to have obtained his information partly from Ellis's writings and partly from his daughter, having received from her "all her father's original scientific correspondence and other papers." These documents are now preserved in the library of the Linnean Society. The biographical account given by Boulger (1889) would appear to have been based largely on Smith's biography.

---

* The volume of Rees's "*Cyclopaedia*" in which this article appears is dated "1819"; according to Jackson (1896), the correct date of publication is as given above.

Ellis's first major work on the "zoophytes" (Ellis, 1755) included descriptions only of a few organisms referable to the algae at the present day. According to the notes in the introduction, the descriptions and figures were based on specimens sent to him by collectors, together with other specimens collected on his various journeys to the coasts of Kent and Sussex. The specimens were mounted on sheets of paper and then arranged " on thin boards covered with clean white paper, in such a manner as to form a kind of landscape, making use of two or three sorts of the *Ulva marina* or sea liverwort of different colours, in designing a variety of hills, dales and rocks, which made a proper groundwork and keeping for the little trees, which the expanded sea-plants and corallines not unaptly represented " (Ellis, 1755, pp. v, vi). Ellis referred to these arrangements of specimens as " landscapes " or " pictures." From his notes it would appear that several of these exhibits were produced, four of them being exhibited to the Royal Society in June, 1752 (Ellis, 1755, p. vi). This exhibition was probably the basis for the report by Smith (1809) that Ellis " presented a collection of these new-discovered animals to the Royal Society." Smith states also that this " original collection still remains in four glazed frames, over the chimneypiece of an apartment in the British Museum " ; the apartment in question being presumably in the original building in which the Museum was housed (Montague House). At the present time no trace can be found of this collection, and it would appear to have been lost.

In a later publication (Ellis, 1767), several entities then regarded as species of the genus *Conferva* were described, principally on the basis of specimens collected at Brighton in 1754. Ellis's last work, issued posthumously, having been edited and made ready for publication by Solander (Ellis and Solander, 1786) contains descriptions and figures of a number of species collected *after* June, 1752, the date of the Royal Society exhibition, so that the original material cannot have been included in the demonstration. The only indications of the present whereabouts of this material are given in statements by Smith and Dawson Turner. Smith (1809) comments that Ellis's daughter gave to him " some specimens illustrative of his writings," although he adds that " the bulk of Mr. Ellis's museum was however sold by auction in London in June, 1791." A search of the Smith herbarium, now preserved at the Linnean Society, London, disclosed the presence of a number of algae, with annotations indicating that they had passed through Ellis's hands. Unfortunately the algae are all of tropical origin and there appear to be none of the original specimens on which Ellis based the new species of *Conferva*. Several of the specimens bear references to T. F. Forster and one has the date " 1791 " marked upon it, the full inscription reading " Mr. Ellis's collection exotic Mr. T. F. Forster 1791." It has not been possible to obtain any details of the sale of the Ellis collections, so that it is not known whether the collections were bought by a single purchaser or disposed of in lots. The references to T. F. Forster, in particular to that associated with the date 1791, suggest that he was possibly the purchaser, although there is no further evidence in support of this supposition. None of these specimens has an annotation in Ellis's hand ; this could be the result of their removal by Smith, who unfortunately was in the habit of removing original labels from the specimens which came into his possession (as in the case of the Hudson specimens in the Hugh Rose collection (Dixon, 1959)), or it could be an indication that Ellis did not annotate his specimens. As will be seen from the comments made by Dawson Turner, the latter explanation is more likely. Turner refers to the Ellis specimens on a number of occasions, but he does not give any indication of the ownership of these specimens at the time. Under *Fucus striatus* (Turner, 1808, p. 32), *F. obtusus* (p. 40), and a number of other species, there are comments which indicate that the Ellis specimens had no indication of the place of collection, whilst at a later date Turner (1819, p. 12) described *Fucus fasciculatus* on the basis of a specimen in the Ellis herbarium, stating " I have seen no other specimen than the one here represented, and whence this came, there are, unfortunately, no means of discovering, no memorandum being attached to any of the marine plants preserved in the Ellisian herbarium." The majority of the Ellis specimens discussed by Turner are tropical, and there appears to be no mention of any of the specimens used by Ellis (1767) in his description of the species of the genus *Conferva.* There is nothing in Turner's works to indicate that he was ever the possessor of the Ellis collections, and at the present time there are no obvious traces of Ellis specimens at the herbarium of the Royal Botanic Gardens, Kew, where the bulk of the Turner herbarium is now preserved.

As has been stated, the few Ellis specimens which have been located in the Smith herbarium, and the specimens discussed by Turner, are largely of tropical affinity, presumably received by Ellis from correspondents. No trace has been found, neither are there any comments by subsequent authors, on the specimens used by Ellis in his original descriptions of species of the genus *Conferva.* The specimens were collected on a visit to Brighton in June, 1754, about which Ellis has stated " I prevailed on Mr. Ehret, a gentleman universally known to the learned botanists of Europe, for his exquisite manner of designing and painting plants and flowers to accompany me to the seaside at Brighthelmstone [Brighton], in Sussex; there to draw from nature, whatever the microscope presented him." The drawings of animals were published in the following year (Ellis, 1755), whereas the drawings and descriptions of species of *Conferva* were not published until much later (Ellis, 1767). In the latter publication, the information given would appear to consist very largely of the original observations. Furthermore, in the introduction to the earlier work (Ellis, 1755, pp. xii–xiv) the method of preservation of the animal specimens is described in detail, but no information is given as to the method of preservation of the specimens of *Conferva.* These observations, together with the statement quoted above, that the illustrations were drawn " from nature," could be interpreted as an indication that the algal specimens were examined only in the living state and not preserved.

There is thus, at the present time, little hope of locating any genuine Ellis herbarium specimens. Such specimens as have been located do not bear labels inscribed in Ellis's hand, and can be identified as having belonged to him only as a result of annotations by other authors. The acceptance of these annotations, without supporting evidence, is to be deprecated. In addition, there is some evidence to suggest that certain of the specimens discussed by Ellis may never have been preserved. The reputed occurrence of the Ellis herbarium at the British Museum (Newton, 1952) is clearly the result of the donation of the four framed demonstration exhibits, whilst the report of Ellis specimens in the herbarium of the Royal Botanic Gardens, Kew, is probably a result of the comments made by Turner, but, as has been shown, there is nothing to indicate that Turner ever possessed the Ellis herbarium, and there are no obvious traces of it at Kew at the present time. Despite a detailed investigation, the basis for the statement that some part of the Ellis herbarium was preserved at the Royal College of Surgeons has not been elucidated. From the comments made by Turner, and from the evidence of the few Ellis specimens in the

Smith herbarium, it would appear that Ellis did not annotate his specimens in any way, so that the chance of identifying a genuine Ellis specimen is extremely small, should there be any still in existence, at the present day. It would seem best, therefore, to assume the loss of the collection, in so far as the algal specimens are concerned. In nearly all cases the illustrations given by Ellis are reasonably good and adequate for identification, so that, under the circumstances, it would appear that the most logical solution to the problem of typification will be achieved by the designation of the illustration as the nomenclatural type, for each of the species involved.

I am indebted to Mr R. Ross, Mrs Y. Butler and Miss C. I. Dickinson for help and assistance in the preparation of this note, and I should like to thank the Directors of the British Museum (Natural History) and of the Royal Botanic Gardens, Kew, for permission to examine herbarium specimens. I am indebted to the Council of the Linnean Society for permission to examine the Ellis correspondence and papers and to search the Smith herbarium for Ellis specimens.

References

Boulger, G. S., 1889. John Ellis, *in Dictionary of National Biography*, **17,** 285–286.

Dickinson, C. I., 1952. Collectors who have contributed British and Irish specimens to the algal herbarium of the Royal Botanic Gardens, Kew, to the year 1910. *Brit. phycol. Bull.*, **1** (1), 11–14.

Dixon, P. S., 1959. Notes on two important algal herbaria. *Brit. phycol. Bull.*, **1** (7), 35–42.

Ellis, J., 1755. *An essay towards a natural history of the Corallines and other marine productions of the like kind, commonly found on the coasts of Great Britain and Ireland.* London.

Ellis, J., 1767. On the animal nature of the genus of Zoophytes, called *Corallina. Phil. Trans.*, **57,** 404–427.

Ellis, J., and Solander, D. C., 1786. *The natural history of many curious and uncommon Zoophytes, collected from various parts of the globe by J. Ellis. Systematically arranged and described by D. C. Solander.* London.

Jackson, B. D., 1896. The dates of Rees's *Cyclopaedia. J. Bot., Lond.*, **34,** 307–311.

Koster, J. T., 1954. Preliminary list of the type collections of algae. *Brit. phycol. Bull.*, **1** (2), 25–28.

Koster, J. T., 1957. Type collections of algae. *Taxon*, **6,** 49–54.

Koster, J. T., 1958. Type collections of algae. Additions. *Taxon*, **7,** 81–82.

Koster, J. T., 1960. Type collections of algae. Additions and corrections. *Taxon*, **9,** 90.

Newton, L. M,, 1952. Preliminary list of herbaria at the British Museum of Natural History, South Kensington. *Brit. phycol. Bull.*, **1** (1), 14–19.

Smith, J. E., 1809. John Ellis *in* Rees, A., *Cyclopaedia*, vol. 12, sect. 2.

Turner, D., 1808. *Fuci, sive plantarum fucorum generi a botanicis scriptarum icones descriptiones et historia*, **1.** London.

Turner, D., 1819. *Ibid*, **4.**

Womersley, H. B. S., 1956. A critical survey of the marine algae of southern Australia. *Austr. J. Mar. Freshw. Res.*, **7,** 343–383.

P. S. Dixon

Dept. of Botany,
University of Liverpool

LETTERS TO THE EDITOR

HETEROMORPHIC LIFE-HISTORY AS A FAMILY CRITERION IN THE CLADOPHORALES

The genera *Acrosiphonia* and *Spongomorpha* have recently been separated from the Cladophoraceae by Jónsson (1959 b) and placed, together with the genus *Urospora*, in a newly created family, the Acrosiphoniaceae. The circumscription of these three genera is not defined, but Jónsson suggests that they have a number of characteristics in common which distinguish them from the genus *Cladophora* :—

(a) a distinct type of cellulose in the cell-wall structure ;
(b) a distinct type of plastid ;
(c) a heteromorphic life-history.

Jónsson brings evidence from his own work to support the use of the first two of these characters in this connection, while Nicolai and Preston (1952 and 1959) have demonstrated clearly the distinctness of the wall structures between the genera *Spongomorpha* (including *Acrosiphonia*) and *Cladophora*.

Jónsson (l. cit.) regards the third character, that of a heteromorphic life-history, as very important in distinguishing the family Acrosiphoniaceae. Such heteromorphic life-histories have now been reported for a number of species of algae belonging to this complex, and they have been worked out by methods combining field observations and laboratory culture work. The following table summarizes these findings.

Phase I forming gametes	*Phase II* forming zoospores	*Authority*	*Position of Meiosis* in the life-history
Urospora mirabilis Aresch.	*Codiolum gregarium* A. Br.	Jorde 1933	*Uncertain.* Not found in Phase I (*Urospora*).
Acrosiphonia spinescens Kjellm.	*Codiolum petrocelidis* Kuck.	Jónsson 1959a	*Uncertain.* Not found in Phase I (*Acrosiphonia*).
Spongomorpha coalita (Rupr.) Collins	*Codiolum petrocelidis* Kuck.	Fan 1959	*Uncertain.* No cytological work reported.
Spongomorpha lanosa (Roth) Kütz.	*Chlorochytrium inclusum* Kjellm.	Jónsson 1959b	*Uncertain.* Not found in Phase I (*Spongomorpha*).

Recently a *Codiolum* phase has been found by one of us (A.A.) in the life-history of *Cladophora rupestris* (L.) Kütz. Swarmers released and grown in culture developed into *Codiolum*-like plants, and in one instance meiosis was observed in cells of the plant producing the swarmers. Two different modes of behaviour were shown by the *Codiolum* plants : some reproduced directly, while others remained vegetative and eventually formed cross walls and grew out into filaments. The *Codiolum* phase may not be an obligate part of the life-history of *Cladophora rupestris* ; it may be a phase produced by special conditions in the environment, another instance of the extreme plasticity exhibited by algae. Until more is known about the exact positions of meiosis and syngamy in the life-histories of algae belonging to the Cladophorales and the variations which can be caused by specific environmental conditions, the significance of the *Codiolum* phase cannot be assessed. Work on this problem is continuing. In the meantime, the finding of a heteromorphic life-history for *Cladophora rupestris*, whether obligate or not, suggests that this is not a sound character to support the creation of the family Acrosiphoniaceae.

REFERENCES

FAN, KUNG-CHU, 1959. Studies on the life histories of marine algae, I. *Codiolum petrocelidis* and *Spongomorpha coalita*. *Bull. Torrey bot. Cl*,, **86,** 1–12.

JÓNSSON, S., 1959a. L'existence de l'alternance hétéromorphe de générations entre *l'Acrosiphonia spinescens* Kjellm. et le *Codiolum petrocelidis* Kuck. *C.R. Acad. Sci., Paris,* **248,** 835–837.

JÓNSSON, S., 1959b. Le cycle de développement du *Spongomorpha lanosa* (Roth.) Kütz. et la nouvelle famille des Acrosiphoniacées. *C.R. Acad. Sci., Paris,* **248,** 1565–1567.

JORDE, I., 1933. Untersuchungen über den Lebenszyklus von *Urospora* Aresch. und *Codiolum* A. Braun. *Nytt Mag. Naturv.*, **73,** 1–19.

NICOLAI, E., and PRESTON, R. D., 1952. Cell-wall studies in the Chlorophyceae, I. A general survey of submicroscopic structure in filamentous species. *Proc. roy. Soc., B,* **140,** 244–274.

NICOLAI, E., and PRESTON, R. D., 1959. Cell-wall studies in the Chlorophyceae, III. Differences in structure and development in the Cladophoraceae. *Proc. roy. Soc., B,* **151,** 244–255.

ANN ARCHER
E. M. BURROWS

Hartley Botanical Laboratories,
University of Liverpool

SOME BRITISH FRESHWATER MATERIAL OF *ASTEROCYTIS*

Asterocytis has been obtained from brackish habitats in Britain (Harvey, 1849, plate 213, as *Hormospora ramosa*; Newton, 1931), but there is apparently only one British record for fresh water (West, 1912). The identity of West's material is doubtful, however, as his " *Asterocytis halophila* (Hansg.) Forti " had no pyrenoids and he regarded it as " a typical member of the Chroococcaceae." In view of this uncertainty it was thought worth while to give a short account of several recent collections of *Asterocytis* from fresh water in various parts of the country.

Material has been collected from the following places: Cheshunt, Hertfordshire, in a gravel pit, August 1956; King's Weir, on the River Lee, Hertfordshire, 1957; Flatford Mill, on the River Stour, September 1957; Mount Batten, Plymouth, on a wet rock face, August 1958; Southgate, London, in a duck-pond, December 1959; and Raasay, Loch a Chadha Charnaich, April 1960. Several isolated cells were also found by Dr J. W. G. Lund in Gordale Beck, Malham, 1957.

With the exception of that from Raasay, the *Asterocytis* was fairly uniform in appearance and resembled that described by Waern (1952) as *A. ornata* (Agardh) Hamel and by Geitler (1924) as *Allogonium smaragdinum* (Reinsch) Hansg.

In the gravel pit at Cheshunt *Asterocytis* was found growing as an epiphyte on old filaments of *Cladophora* sp. and also on the bark of submerged twigs. The plants occur here as branched filaments, the longest being about 1 mm. (Fig. 1b).

The cells are uniseriate and embedded in the mucilaginous matrix of the filament. Individual cells are surrounded by a more or less well-defined wall. Growth is both terminal and intercalary, the branching being false (Fig. 1a).

As with Geitler's material, single cells often emerge from the filament either terminally or laterally (Fig. 1c). For this reason isolated cells or pairs of cells are more often found than large filaments (Fig. 1d).

Each cell contains a large central pyrenoid and a stellate chromatophore, bright blue-green in colour, which gives a distinctive appearance to the whole plant. Around the pyrenoid, between the arms of the chromatophore, are starch-like grains. The nucleus lies to one end of the cell.

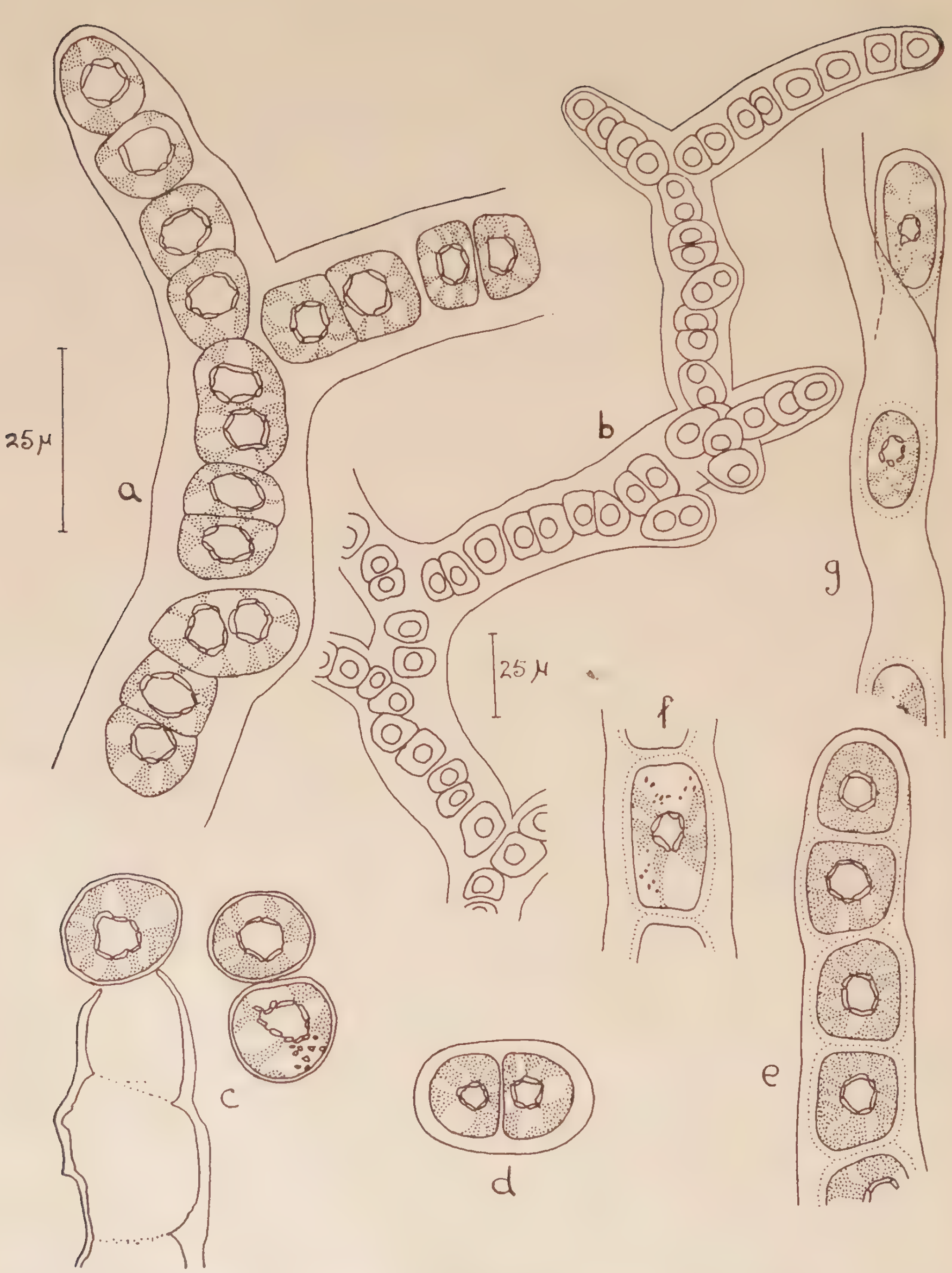


FIG. 1. a, part of a filament of *Asterocytis*; b, the same filament at a lower magnification; c, the release of cells; d, isolated pair of cells, all from Cheshunt; e, part of a filament from Southgate; f, the same from Plymouth; g, the same from Raasay. (All to the same scale, except b.)

In the same collections were found irregular cushions of *Asterocytis* cells embedded in mucilage, resembling Waern's *Asterocytis wolleana* "*pulvinata*."

The collections from King's Weir and Flatford contained a few isolated cells similar to those described, while the pond at Southgate contained well-developed filaments, epiphytic on filamentous Chlorophyceae (Fig. 1e).

The collection at Plymouth was made from an overhanging limestone rock above high-water level, down which fresh water trickled continually. The *Asterocytis* occurred over an area approximately 120 cm. wide and extending for two metres upwards from the zone of *Xanthoria*. The surface of this area was coloured yellow owing to mucilage containing filamentous blue-green algae and diatoms. At a depth of about 1 mm. the *Asterocytis* occurred in an almost pure stand mixed with granules of calcium carbonate, forming a blue-green layer 2–3 mm. deep over the whole of the area. In some places where water dripped from the rock the algae formed blue-green mucilaginous masses on the surface.

The cells of this material (Fig. 1f) closely resembled those obtained from Cheshunt, but tended in places to be more widely spaced in the filaments. These were much branched and difficult to sort out from the granules of calcium carbonate.

The collection from Raasay was made by Miss J. C. Hughes from Loch a Chadha Charnaich, a pool among Jurassic rocks with water of pH 8·2. Short filaments and isolated cells occurred sparsely in a crust of blue-green algae and calcium carbonate on a stone from this loch. The cells were much smaller than those of previous collections (4–8 μ in diameter instead of 11–15) and they were spaced at longer intervals in the branched filaments (Fig. 1g).

It is noteworthy that all the above collections were made from calcareous waters or incrustations. The salinity of most of the habitats was not known, but the plants from Cheshunt, King's Weir and Southgate were all growing in water containing about 50 p.p.m. of chloride.

Filaments from Cheshunt, Southgate and Plymouth were grown in culture, in north daylight, using the medium No. 10 of Chu as modified by Rodhe (1948), and with an added trace-element mixture. All grew well in liquid cultures and on agar. On agar plates the isolated cells escaping from the filaments moved over the surface of the medium leaving trails, as described by Rosenberg (1935). In liquid culture the cells in the actively growing filaments are arranged more closely and in a more orderly manner than those of most wild material, and resemble the filament depicted by Geitler (1924, Fig. 6).

Freshwater Biological Association,
The Ferry House,
Far Sawrey, Ambleside, Westmorland

J. H. Belcher
E. M. F. Swale

References

Geitler, L., 1924. Über einige wenig bekannte Süsswasserorganismen mit roten oder blaugrünen Chromatophoren. Zugleich ein Beitrag zur Kenntnis pflanzlicher Chromatophoren. *Rev. algol.*, **1**, 358–375.

Harvey, W. H., 1849. *Phycologia Britannica.* London.

Newton, L., 1931. *A Handbook of the British Seaweeds.* London.

Rodhe, W., 1948. Environmental requirements of fresh-water plankton algae. *Symb. bot. upsaliens.*, **10**, 1–149.

Rosenberg, M., 1935. Über die Bewegung der Einzelzellen von *Asterocytis Smaragdina* Reinsch. *Arch. Protistenk.*, **85**, 251–254.

Waern, M., 1952. Rocky-shore algae in the Öregrund Archipelago. *Acta phytogeogr. Suec.*, **30**, 1–298.

West, G. S., 1912. Algological notes, XIII. New and interesting British freshwater algae. *J. Bot., Lond.*, **50**, 328–331.

OBSERVATIONS ON THE SPORE OUTPUT OF SOME COMMON RED ALGAE

In the course of a study of the ecology and biology of certain red algae (Boney, 1959), some estimates were made of the spore output of fruiting thalli. The plants were placed in finger-bowls containing filtered sea water and the liberated spores collected in petri dishes. After a certain time interval, the plants were removed and carefully rinsed, in order to free any spores trapped in the branches. The water was then siphoned from the finger-bowls, leaving the petri dishes containing the released spores filled with water. Samples of sea water containing spores were withdrawn from each petri dish with a pipette and transferred to a watch glass, and the spores were counted with a binocular microscope (magnification × 50). After removal of the water from the petri dish, the spores remaining attached to the dish were counted. The following table gives a summary of the results obtained. The spore output is shown as output per 1 gm. fresh weight per hour.

TABLE

Spore output of various red algae, expressed as output per 1 gm. fresh weight per hour.

Species	*Type of spore*	*Fresh weight of thallus (gm.)*	*Total spores*	*Output per 1 gm. fresh weight per hour*
Ceramium ciliatum	Tetraspores	3·3	73,500	438
Polysiphonia urceolata	,,	0·35	5,330	354
Plumaria elegans	,,	8·0	26,790	152
Polysiphonia lanosa	,,	20·0	3,724	16
Laurencia pinnatifida	,,	10·8	2,040	10
Polysiphonia nigrescens	,,	10·0	1,073	5
Antithamnion plumula	Carpospores	0·8	14,410	760
Polysiphonia lanosa	,,	12·1	300	2

Although the thalli appeared to be in an extremely fertile condition, it is possible that the plants failed to reach their peak period of spore output in the time of experiment. However, it will be noted that the species which tend to make a shorter annual appearance on the shore have a noticeably greater spore output per hour than the species with more protracted fruiting periods. There are also differences in spore size. Tetraspores of *Laurencia pinnatifida* and *Polysiphonia lanosa* are larger than those of *Ceramium ciliatum* and *Plumaria elegans*. This feature of the economy of spore production might prove a useful study, since there appears to be little quantitative data on the reproductive capacity of red algae.

A tetrasporangium-bearing plant of *Plumaria elegans*, collected from the lower mid-littoral at Wembury, south Devon, during November, 1955, was carefully dissected, and all the tetrasporangia borne on the branches were counted. The weight of the plant (after preservation in formalin alcohol) was 6·0 gm. Three types of sporangium condition were identified:

(a) ‘ developing ’ sporangia;

(b) ‘ mature ’ sporangia (containing spore tetrads);

(c) sporangia which had released their spores.

In addition, the sporangia which had failed to release their spores were noted. Within these abortive sporangia, the spores appeared as a contracted green mass. The results of the sporangium count are summarized below:

Condition of sporangium	*Number*	%
(a) ‘developing’	7,793	16·4
(b) ‘mature’	29,643	62·3
(c) ‘spores released’	9,587	20·3
(d) ‘abortive’	364	0·8

The number of abortive sporangia is clearly very small. The potential spore output of this plant, estimated from the number of sporangia containing spore tetrads, was equal to 118,572 spores. By contrast, the actual spore output measured for a *Plumaria* plant of 8 gm. fresh weight (see table) was 26,790 spores over a 22-hour period. On the south-west coast, *Plumaria* produces tetraspores throughout autumn, winter and spring. Since it is likely that the plants can produce successive crops of sporangia, the annual spore output must be prodigious.

REFERENCE

BONEY, A. D., 1959. The ecology and biology of certain intertidal red algae. Ph.D. Thesis, London.

A. D. BONEY

Dept. of Chemistry and Biology,
Plymouth Technical College

THE SPORE OUTPUT OF *ANTITHAMNION PLUMULA* OVER A NUMBER OF DAYS

A tetrasporangium-bearing plant of *Antithamnion plumula* was taken from the ‘Drake's Island’ tank at the Plymouth laboratory of the Marine Biological Association of the United Kingdom on August 25th, 1959. The individual branches were separated from the mass, and then placed on glass slides immersed in filtered sea water in a shallow glass dish. The plant material was left for 24 hours, and the whole sample was then transferred to another dish containing sea water and slides. The transference of fruiting material was repeated every 24 hours over a six-day period. The slides were left undisturbed for three days after the removal of the fruiting branches to ensure attachment of the released spores. The experiments were carried out at constant temperature (16°C.) and with continuous lateral fluorescent illumination (shaded to 150 lux). Ten slides were used for each experiment. After the three-day ‘attachment’ period, the sporelings growing on each slide were counted under a binocular microscope (magnification × 100). The results are summarized in the following table.

TABLE

Number of sporelings obtained from a fruiting tuft of *Antithamnion plumula* (dry weight = 0·0082 gm.)

Day	*No. of sporelings*	*% of total*
1	5,255	51·7
2	1,996	19·8
3	1,606	15·9
4	818	8·1
5	261	2·6
6	135	1·3
Total	10,071	

The results show that just over 50% of the spores were released in the first 24 hours, the number falling to about 20% in the second day, and then to 16% after three days. A rough estimate based on the results in the Table indicates that a fertile plant of *Antithamnion* of 1 gm. dry weight might be expected to yield 1·25 million spores over a six-day period.

A. D. BONEY

Dept. of Chemistry and Biology,
Plymouth Technical College

NURTURE OF A FRUITING *ANTITHAMNION* TUFT AND THE PHYSIOLOGICAL CONDITION OF THE LIBERATED SPORES

The following experiment was carried out with tetrasporangium-bearing tufts of *Antithamnion plumula*, taken from the ‘ Drake's Island ’ tank at the Plymouth laboratory of the Marine Biological Association of the United Kingdom on August 20th, 1959. Equal fresh weights were taken, one sample placed in a finger-bowl containing Erd–Schreiber medium (Föyn, 1934), and the other in filtered sea water. The same volumes of culture medium were used, and the plant material was left at constant temperature (16°C.) with lateral fluorescent illumination (shaded to 150 lux). After 12 days under these conditions the plant material was removed from the finger-bowls, rinsed in filtered sea water, and then separated into individual branches. The branches were then left overnight on slides immersed in filtered sea water (10 slides used for each plant sample), and the slides were left for a further two days. After this “ spore attachment ” period, the slides were placed in 200 ml. Erd–Schreiber medium contained in 250 ml. Pyrex flasks capped with beakers and left for five days under the conditions of temperature and illumination already described.

Comparison of the states of development reached by the sporelings should give some indication of the inherent vigour of the spores. The number of cells produced by the sporeling crop was counted by the method described in earlier work (Boney, 1959 ; Boney, Corner and Sparrow, 1959). After counting the number of cells produced by a sporeling crop, the cell production was calculated for 100 sporelings and the number of cells produced in the two-day “ attachment ” period was subtracted. Development was then compared as the number of cells produced by 100 sporelings per day of experiment (see table).

TABLE

Cell production of *Antithamnion* sporelings after culture of parent thallus for 12 days (a) in Erd–Schreiber medium, (b) in filtered sea water

	Parent thallus immersed 12 *days in:*	
	(a) *Erd–Schreiber medium*	(b) *Filtered sea water*
Number of sporelings	271	231
Cells per 100 sporelings per day	21·4	9·8
Dry weight of parent thallus	0·023 gm.	0·020 gm.

Sporelings grown from spores which developed on the plant material kept in the Erd–Schreiber medium showed a growth rate which was double that of sporelings from material kept in filtered sea water. Since the fruiting tufts were kept in the culture media for 12 days prior to the release of the spores used in the experiment, it seems likely that the relatively small number of spores obtained would have developed whilst immersed in the culture media. The advantage gained by spores developed in an enriched medium is clearly shown in the subsequent sporeling growth.

REFERENCES

Boney, A. D., 1959. The ecology and biology of certain intertidal red algae. Ph.D. Thesis, London.

Boney, A. D., Corner, E. D. S., and Sparrow, B. W. P., 1959. The effects of various poisons on the growth and viability of sporelings of the red alga *Plumaria elegans* (Bonnem.) Schm. *Biochem. Pharmacol.*, **2**, 37–49.

Föyn, B., 1934. Lebenszyclus, Cytologie und Sexualität der Chlorophycee, *Cladophora suhriana* Kütz. *Arch. Protistenk.*, **83**, 1–56.

A. D. Boney

Dept. of Chemistry and Biology,
Plymouth Technical College

REVIEWS

Fott, B. *Algenkunde*. Pp. vi + 482, with 255 figures in the text. Gustav Fischer, Jena, 1959. Price £4 10s. 0d.

This textbook covers the whole of phycology in less than 500 pages. The main part is devoted to structure and reproduction (388 pages), the two lesser parts to ecology and distribution (45 pages) and applied phycology (32 pages). Any specialist may feel that there are aspects of his own subject which have been treated in too cursory a manner and others which should not have been omitted. The plan of the book is, however, to give a general oversight of our knowledge of algae and not to produce a complete account of everything that is known about them. This plan has been carried out very well. Especially pleasing is the balance held between the accounts of the algal groups. The temptation to write a great deal about, for example, Rhodophyta, Phaeophyta and Myxophyta, and relatively little about other groups, has been resisted. Many of the figures and photographs are originals made by the author and other Czech phycologists, such as Komárek, Cyrus, Fiala, Ručička and Ettl. The vast majority are excellent. One may regret the choice of Janet's figures in place of Pocock's beautiful photographs of *Volvox*, and the use of Stein's often reproduced figure of *Synura*, which gives a too diagrammatic impression of the chromatophores and an incorrect one of the flagella. In the accounts of each algal group there are sections on ecology and distribution. Though such details are welcome, much of what is given in them is repeated later on in the part of the book devoted to these matters. The only irritating feature of the book is the citation of literature. Authors and dates are often cited in the text which are not to be found in the references. Indeed the reverse may occur and a paper be cited in the references which is not mentioned in the text. The articles specially marked in the lists of references as being the most important are not always happy choices; notably in the section on ecology.

In the section devoted to blue-green algae Fott argues in favour of the name Cyanophyta. The classification here is basically that of Geitler. The Chrysophyceae are divided into Chrysomonadales, Rhizochrysidales, Chrysocapsales, Chrysophaerales and Phaeothamniales. That the biflagellate, heterokont genera should be grouped with the uniflagellate ones is in accord with modern knowledge. It is less certain that the Prymnesiaceae (*Prymnesium*, *Chrysochromulina*, etc.) should be included in this order. However, the author was faced with a difficult decision, because we do not yet have sufficient information to be able to determine the interrelationships of the flagellate forms. Equally the view may be held that the rhizopodial forms (Rhizochrysidales) are not so different from the flagellate ones to justify separation in another order. Further difficulties arise in separating palmelloid (Chrysocapsales) from coccoid (Chrysophaerales) forms.

The classification of the Phaeophyta follows that of Papenfuss. In the Rhodophyta he steers a cautious course between the views of the chief authorities. In order to keep this chapter within reasonable bounds he has limited the description of the manifold detailed variations in sexual reproduction. In so doing he ensures an account which makes the general understanding of these matters less forbidding than it sometimes seems to be. At the risk of offending specialists, I, as a non-specialist, found this a welcome approach. Once again in the Chlorophyta the subdivisions are a matter of opinion. Fott has three classes, Chlorophyceae, Conjugatophyceae and Charophyceae. He retains the Tetrasporales as a group lying between the flagellate and coccoid forms, but admits the difficulties involved in so doing.

The Pyrrophyta includes the Desmophyceae and Dinophyceae but, contrary to Pascher, excludes the Cryptophyceae. This is surely correct, for the details of the cell structure of cryptomonads are strikingly different from those in, for example, the dinoflagellates. The Cryptophyceae and Chloromonadophyceae he places in a section entitled " Gefärbte Flagellaten unsicherer Stellung." Is this logical? Are they of any less certain position *vis-à-vis* other algal groups than are, for example, the Rhodophyta, Dinophyta or Euglenophyta? Moreover, if morphological elaboration is advanced in favour of this viewpoint, then if we have Euglenophyta should we not also have Cryptophyta and Chloromonadophyta?

The amount of literature on the ecology and biology of algae is so enormous, diverse, diffuse and contradictory that it is not surprising that Fott has taken what may be called a conservative viewpoint. This leads to the repetition of some " textbook " statements which are open to doubt or contradiction. However, the section as a whole provides a readable introduction to the subject. The valuable section—Die Bedeutung der Algen für den Menschen—contains much interesting information on fisheries, reservoir practice, toxic algae, alginates, agar-agar, kieselguhr and other aspects of the utilization of algae. Of especial interest is the description of the ecology of carp ponds, notably those with virtually unispecific blooms of *Aphanizomenon* and great populations of *Daphnia*. Here also one can find valuable information about Russian work. Perhaps the most fascinating glimpse of algal utilization is the account of the Russian use of *Cladophora* and *Rhizoclonium* for making such high-grade paper that it is even suitable for bank notes.

All in all, this is a welcome presentation of the subject. Whether the book is written in first-class German or not—and I suspect that it is—it is most beautifully written for those who are not Germans. The sentences are models of clarity and precision, certainly by some German standards, and the ease with which the book can be read masks the magnitude of the task undertaken. Here is the perfect book for the study of phycology and German at the same time. As might be expected, the book is beautifully produced by the famous firm of Gustav Fischer. There are relatively few misprints and about half of them are included in an errata slip.

There was no recent, coherent, general textbook of phycology available. Professor Fott has filled this gap, and filled it so well that his book is likely to have the success it so thoroughly deserves.

J. W. G. L.

KING, C. A. M. *Beaches and Coasts.* Arnold, London, 1959. Price £3 5s. 0d.

A modern summary of research on shore processes has been needed for some time, and this book will be welcomed by all who are interested in the sea and coasts.

The action of waves, winds and tides on mobile beaches is very fully treated. The theoretical background is given with a useful evaluation of various formulae which, in some fields (such as wave generation theory), differ considerably. Experimental work, both in wave tanks and on the shore, is also well covered. Less space is given to rocky coasts, reflecting the smaller amount of work done on them, a natural result of the economic necessity for studies of beach erosion.

The chapters on the building up and destruction of beaches include a discussion of the beneficial and (all too often) harmful effects of various coast defence works, and a brief outline of the part played by vegetation in the development of dunes and salt marsh.

In addition to the details of shore processes, the changes in major coastal features over long periods of time are described. The classifications of coasts, from that of D. W. Johnson onwards, are discussed, and an account is given of the historical evidence for coastal changes.

Botanists with only rudimentary mathematics and physics are warned that they will meet heavy weather in the condensed account of the basic theory of waves and tides in the first chapter, but are urged not to let this put them off a work which all can read with pleasure and profit.

A useful summary is given at the end of every section and there is an extensive bibliography.

W. E. J.

Freshwater Biological Association. Twenty-seventh Annual Report (for the year ended 31st March 1959). Price 4s.

In the Director's report on the scientific work of the staff, there are some references to Dr Lund's Presidential Address to the Phycological Society published in the last number of the *Bulletin*. In relation to observations on μ-algae, it is pointed out that in Windermere the results do not suggest that the μ-algae are quantitatively more important than the larger forms, as may be the case elsewhere. However, the lack of knowledge about the effect of grazing is emphasized. The taxonomy of most of these organisms is also uncertain.

Some 16,000 further illustrations of freshwater algae have been added to the Fritsch Collection. These cover about 5,000 species.

Work on stream algae has been largely concerned with the autecology of *Cocconeis* (especially *C. placentula*) and the possible effect of bacteria of the *Proteus* group on the growth of *Achnanthes minutissima* in culture.

In studies on primary production it has been found that the cells of *Asterionella formosa* taken from different depths may diverge in several photosynthetic characteristics. From the data obtained it will be possible to derive some comparative values for photosynthetic production below unit area. The photosynthetic behaviour of *Melosira italica* has also been studied.

Some new records of interesting chytridiaceous fungi infecting algae are given. A collection of figures of such simple aquatic fungi is being made on the same lines as the Fritsch Collection.

More information about the chemistry of cores obtained from several lakes with the Mackereth corer is now available and may well be of phycological value when the diatom remains are analysed.

After the usual list of papers published by members of the staff, there is a list of the limnological papers published in the British Isles in 1958, including 44 on algae.

J. W. G. L.

News Bulletin of the Phycological Society of America, Vol. XII, Nos. 36 and 37. 1959.

Volume XII of the *News Bulletin* contains a list of more than 1,100 references in phycological literature for 1957. These are again listed alphabetically and not divided into subjects; but the Editor, with the help of an international group of phycologists, has drawn up a code showing the language used in the texts, and, for the most part, either the title or a summary of the paper is translated into English. In this way, an extensive cover of the world literature in phycology is listed, and this will, no doubt, be of very great interest and help to British phycologists.

E. C.

NEWS ITEMS

The Fourth International Seaweed Symposium will be held in Biarritz on September 18th–21st, 1961, and will be followed by post-Congress excursions to the Basque coasts on September 22nd–25th.

The Symposium will be devoted to biological, chemical and utilization studies of marine algae. Members of the British Phycological Society who would like to know further details are invited by the President (Dr Ad Davy de Virville) to contact the Organizer: Monsieur BARRIETY, Directeur du Centre Scientifique, B.P. 28, BIARRITZ, Basses-Pyrénées, France.

It is proposed to publish a microcard edition of Kutzing's *Tabulae Phycologicae*. The 19 volumes and the index will be produced on 85 microcards (or microfiche) at a cost of £12 15s. 0d. Members of the Society or libraries who are interested in this offer are invited to get into touch with Messrs. Micro Methods Ltd., East Ardsley, Wakefield, Lancs.

The *Tabulae Phycologicae* is also to be produced in America in a microcard edition at a cost of $40.00 by the Microcard Foundation, 901, Twenty-sixth Street N.W., Washington, 7. D.C.

REQUEST FOR RESEARCH MATERIAL

Dr A. D. Boney will be glad to receive material of *Heterosiphonia plumosa* from localities in the British Isles. Material, either air-dried or preserved in formalin/alcohol, should be forwarded to The Laboratory, Citadel Hill, Plymouth, Devon.

OBITUARY

Professor Gilbert Morgan Smith died on July 11th, 1959, and thereby American phycology lost its distinguished senior scientist. The breadth of his interests brought him into contact with all phases of our field, and his influence and personal charm will be widely missed.

Born in Wisconsin on January 6th, 1885, he had his early training in Williston Academy and received the B.S. degree from Beloit College in 1907, being recalled to receive their honorary D.Sc. in 1927. His loyalty to his native state kept him there much of his life, for he went to the University of Wisconsin at Madison as an assistant in 1909, spent 1910–1911 at Pomona College in California, and then returned to Madison as an instructor. He received the Ph.D. degree in botany there in 1913 and continued on the staff until 1925, when, as Associate Professor, he resigned to accept a Professorship at Stanford University, California, which post he held until his retirement. He taught during the summers at various field stations, notably Pacific Grove and, after retirement, at the Douglas Lake station of the University of Michigan.

Professor Smith did not publish a very large number of small papers, but more significantly comprehensive works of enduring value. Notably early was a monograph of *Scenedesmus* based on culture studies (1916). Soon afterwards there appeared his two excellent volumes on the Phytoplankton of the Wisconsin Lakes (1920, 1924), with the fine drawings characteristic of his work in this period. He became involved at this time, with his colleagues, in the preparation of an introductory botanical textbook for colleges, which was immediately successful and has gone through at least five editions (1924–1953). Meanwhile he had prepared a descriptive guide to the *Fresh-Water Algae of the United States* (1933, revised ed. 1950), and a textbook of *Cryptogramic Botany* in two volumes (1938, revised ed. 1955). His attention on arrival in California was turned to the sea, and he prepared a handsomely illustrated handbook of the *Marine Algae of the Monterey Peninsula* (1944, reprinted). However, his participation in marine algal studies did not extend beyond his immediate environment at Pacific Grove so far as publication was concerned. Rather, running parallel, was a return to his student interest in algal culture studies, then cytological, now physiological, for he attempted to follow up some of the more controversial experiments on *Chlamydomonas.* These books and papers had a very notable reception, and Professor Smith's reputation reflected the respect they deserved. He was elected to the National Academy of Scienes and the American Academy of Arts and Sciences, was past-President of the Botanical Society of America, the American Microscopical Society and the Phycological Society of America, and participated as officer or member in many other professional societies and congresses.

Wm. Randolph Taylor